IPAC

CPA-IPAC
GUIDELINES
FOR THE PREPARATION OF
PUBLIC SAFETY
EMERGENCY RESPONSE PLANS
FOR SOUR GAS
DRILLING, COMPLETION, AND SERVICING

September 1991

CANADIAN PETROLEUM ASSOCIATION

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TABLE OF CONTENTS

1. Introduction 1
   - 1.1 Purpose Of Guidelines 1
   - 1.2 Scope 1
   - 1.3 Structure Of Guidelines 1

2. Regulatory Requirements For Public Safety Considerations 3
   - 2.1 Key Terms and Definitions 3
   - 2.2 Approvals 4
   - 2.3 Relevant Regulations 4
     - A) Alberta (ERCB) 4
     - B) British Columbia (MEMPR) 5
   - 2.4 When Response Plans Are Required 6
     - A) Special Sour Well Classification 6
     - B) Population Density Considerations 6
     - C) Evaluation Of Circumstance 6
     - D) Nature Of The Operation 7
   - 2.5 Types Of Response Plans 7
     - B) Reduced Plan 10
     - C) Supplemental Information 10

3. Public Consultation 11
   - 3.1 Issue Identification 11
     - A) Industry Precedents 12
     - B) Historical Concerns 12
     - C) Anticipated Concerns 12
     - D) Area Familiarization 12
     - E) Information Exchanges Among Operators 13
   - 3.2 Resident surveys 13
     - A) Preparation Of Public Information Packages 13
     - B) Residential Contacts 14
     - C) Urban Centres 15
   - 3.3 Conflict Resolution 15

4. Emergency Planning Process 17
   - 4.1 Alternative Means Of Public Protection 17
     - A) Evacuation 17
     - B) Well Ignition 17
     - C) Shelter 17
   - 4.2 Determination Of Planning Zone Size And Configuration 18
     - A) Planning Zone Size 18
     - B) Planning Zone Configuration 20
     - C) Manageability Of The Emergency Planning Zone 20
     - D) Multiple Well Program 21
   - 4.3 Organizational Infrastructure 21
     - A) Government Main Control Headquarters (MCHQ) 21
     - B) Operator's Emergency Operations Centre 22
     - C) Off-Site Control Centre 22
     - D) On-scene Command Post 23
     - E) Evacuation Reception Centre 24

4.4 Defining Response Level Criteria 24
4.5 Alert Level Responses 25
A) Response Team, Support Service, And Government Agency Notification 25
B) Resident Notification 25
C) Evacuation And Area Isolation 26
D) Well Ignition 28
E) Downgrading Alert Levels 28
4.6 Response Team Capability And Equipment Requirements 28
A) Equipment Listings 28
B) Evacuation Coordinator 29
C) Telephoners 29
D) Evacuation Crews 30
E) Roadblocks And Security 30
F) Evacuation Reception Centre 31
G) Air Quality Monitoring 31
4.7 Mapping Requirements 32

5. Plan Contents 35
5.1 Sour Well Plans 35
A) Introduction And Summary 36
B) Area Information And Maps 37
C) Stages Of Alert And Response 37
D) Infrastructure 37
E) Evacuation And Ignition Criteria 37
F) Support Information 37
5.2 Reduced Plans 38
A) Introduction And Summary 38
B) Area Information And Maps 38
C) Stages of Alert And Response 38
D) Infrastructure 39
E) Evacuation And Ignition Criteria 39
F) Support Information 39
5.3 Supplemental Information For Completion Operations 39

APPENDICES

Appendix One - Relevant Government Regulations 41
Appendix Two - Sample Resident Survey Questionnaire And Evacuation Messages 44
Appendix Three - Sample Public Information Package 46
Appendix Four - Medical Effects Of H_2S and SO_2 48
Appendix Five - Administrative Requirements 51
Approval Processes And Timing 51
Waivers 51
On-Site Review Meetings 52
Distribution To Government Agencies 52
Procedures At End Of The Drilling Phase 53

GLOSSARY
INDEX

LIST OF FIGURES

SECTION 2

Figure 2.1 - When Are Emergency Plans Required? (Drilling) 8
Figure 2.2 - When Are Emergency Plans Required? (Completions/Servicing) 9

SECTION 4

Figure 4.1A - Emergency Planning Zone Radius Size ($<1 m^3/s$) 19
Figure 4.1B - Emergency Planning Zone Radius Size ($<12 m^3/s$) 19

SECTION 5

Figure 5.1 - Action Summary Chart 36

1. INTRODUCTION

1.1 PURPOSE OF GUIDELINES

"CPA-IPAC Guidelines For Preparation Of Public Safety Emergency Response Plans For Sour Gas Drilling, Completion, and Servicing (1990)" are intended for use by both novice and experienced Emergency Response Planners. While the guidelines presented include Industry's minimum requirements, steps which can be taken to improve a plan are also addressed.

1.2 SCOPE

These guidelines are intended for use in the development of emergency response plans prepared for the drilling, completion and well servicing operations in the sour oil and gas industry. These emergency response plans deal with issues of public safety.

These guidelines are not intended to be used for other sour operations or facilities. The CPA has prepared the **"Guidelines For Preparation Of Sour Gas Emergency Response Plans For Sour Oil And Gas Facilities"** in April, 1987 for sour facilities.

1.3 STRUCTURE OF GUIDELINES

The guideline's structure is intended to parallel the development process for an emergency response plan. The beginning section (Section 2) deals with the regulatory requirements. It outlines when emergency response plans must be prepared from a regulatory standpoint, and presents a summary of the relevant regulations.

General information on approaches to public consultation is provided in Section 3. Issue identification, other reference guidelines, and public contact information are presented.

Section 4 deals with the planning process itself. Issues covered include how the planning zone size and configuration are determined, the emergency response organization concerns, alert level definitions and response, and mapping requirements.

Once the issues have been identified and the planning process is near completion, the emergency response plan document must be prepared. Section 5 lists the contents required for the various types of plans available to the planner (ie: sour well plans, reduced plans, or supplemental information submissions).

Appendices contain additional detail and background information. A glossary of terms and index are also included at the end of the document.

2. REGULATORY REQUIREMENTS FOR PUBLIC SAFETY CONSIDERATIONS

Emergency response plans covered by these guidelines fall under provincial jurisdiction. Canada Oil And Gas Lands Administration (COGLA) had the jurisdiction in federal lands at the time of the guideline preparation.

This section outlines Alberta's Energy Resources Conservation Board (ERCB) regulatory requirements for emergency response plans as of September 1, 1990. As the ERCB has developed an extensive set of regulations and maintains jurisdiction over the majority of sour gas developments, its regulations and terminology are referenced.

British Columbia's Ministry of Energy, Mines and Petroleum Resources (MEMPR) has similar regulations. COGLA's regulations were not specifically designed for sour gas operations.

An Operator should consult with the appropriate regulating agency if there are questions on regulatory requirements.

2.1 KEY TERMS AND DEFINITIONS

Terminology referenced throughout the guidelines is defined in the glossary found after the appendices. Of these, the term "Special Sour Well" has the most direct impact on the planning process. "Special Sour Well" is the term used in these guidelines to refer to wells which Alberta's ERCB describes as "Critical". These are wells which have high potential impact on the public and warrant more stringent precautionary measures than would other wells. The term "Special Sour Well" is consistent with that used by British Columbia's MEMPR.

A well would be classified as special[1] if it:

a) has a maximum potential H_2S release rate between $0.01 m^3/s$ and $0.1 m^3/s$, and is located within 500m of the corporate boundaries of an urban centre; or

b) has a maximum potential H_2S release rate between $0.1 m^3/s$ and $0.3 m^3/s$, and is located within 1.5km of the corporate boundaries of an urban centre; or

c) has a maximum potential H_2S release rate between $0.3 m^3/s$ and $2.0 m^3/s$, and is located within 5.0km of the corporate boundaries of an urban centre; or

d) has a maximum potential H_2S release rate of $2.0 m^3/s$ or more; or

e) any well the regulating agency deems a special sour well.

This term applies to drilling, completion, and servicing operations.

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1 ERCB's ID 87-2, Section 7; ID90-1 Section 5; MEMPR Procedures Handbook, Appendix 6, Section 6.1.

2.2 APPROVALS

Emergency response plans are to be approved by the regulatory agency prior to licensing or completion for special sour wells, prior to spud for other sour wells[2], and prior to commencing any completion operation during which the wellhead is removed and the sour zone is exposed.[3]

The approval process is described in Appendix 5.

2.3 RELEVANT REGULATIONS

A) Alberta (ERCB)

Information Letters (IL's) and Interim Directives (ID's) with the most relevance to emergency planning issues are outlined below. Additional detail is provided in Appendix 1. If the Emergency Response Planner is unfamiliar with these regulations, reference to the documents is strongly recommended.

a) **Policies On Overlapping Response Planning Zones:** The ERCB has policies regarding operation of wells with overlapping emergency planning zones. Should this situation develop, the ERCB should be contacted to determine the operation restrictions and the required modifications to the emergency response plan.

b) **ID 90-1; (Completion and Servicing Of Sour Wells, Amending IL 84-9):** ID 90-1 includes clarification of sour well emergency response plan requirements and flaring applications for completion or servicing operations. It indicates that a submission to the ERCB is not required if there is an approved sour facility plan that includes the well in question. The plan must have been reviewed by the Operator and contain a resident listing that has been updated in the last 12 months. If the well is in the planning zone of a sour facility response plan, but is not listed itself, supplemental information is to be submitted to the ERCB. Supplemental information must be approved before operations begin. If the well cannot be included in an approved response plan for a sour facility, a site-specific emergency response plan is required.

c) **IL 89-20 (Compensation In Case Of Well Blowout):** IL 89-20 outlines a recommended process to deal with compensation. It outlines a Three Tier process for handling claims and presents an outline on a four stage conflict-resolution process. IL 89-20 impacts emergency response planning as compensation is a closely related issue.

d) **IL 89-15 (Evacuation And Ignition For Sour Wells, Superseding IL 88-14):** A revision of the Board's evacuation and ignition policy. The IL relates to sour wells during drilling, completion, servicing and production operations, and reflects **"Alberta Health Guidelines For Action Regarding H2S"**. It states that the Board's policy is for public evacuation where there are uncontrolled or partially controlled releases of H_2S. Where evacuation is impractical, well ignition will be required.

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2 ERCB's ID 87-2, Section 6.3.4; MEMPR Procedures Handbook, Appendix 6, Section 5.4.
3 ERCB's ID 90-1, Section 3.4.

At concentrations below 10ppm in unevacuated areas, "sensitive"[4] individuals should consider leaving the area if health symptoms persist or become more severe. If concentrations exceed 10ppm for eight hours or more, local conditions will be assessed and all persons may be advised to evacuate.

If concentrations approach 20ppm or more, evacuation of all persons will take place.
Ignition criteria, in terms of conditions at the wellsite and the critical / non-critical status, are also addressed.
Explanations for the concentration measurement procedures are also presented.

e) **IL 89-4 (Public Involvement In The Development Of Energy Resources):** This is an ERCB and Alberta Environment guideline concerning the involvement of Albertans in energy developments. Ideas and suggestions presented are those the ERCB and Alberta Environment have found to be effective in their work with individuals, families, communities, and local governments. It also lists six expectations they have of the energy companies to develop public involvement.

f) **IL 88-17 (Ignition Equipment For Drilling Critical Sour Wells):** All critical wells require dual ignition systems unless a waiver is granted. The primary ignition system shall be installed so that it can be activated by a remote, time-delayed device. The backup can be a manual system.
The Board, upon application, may waive the requirement for dual ignition systems. The application should be submitted independently, and not as part of the plan.

g) **ID 88-9 (Amendment Of ERCB ID 87-2):** ID 88-9 is an amendment to ID 87-2. Amendments of the definitions for urban centres and public facilities are presented.

h) **ID 88-2 (Proposed Wells, Production Facilities, And Pipelines Notification Of Rural And Urban Administrations, Amending ID 81-4):** The ERCB requires applicants to advise urban authorities of proposed wells and pipelines to be located within 1.5km of corporate limits of the urban centre. The ERCB now requires Operators to notify rural authorities of their intent to apply for ERCB approval for any well, facility or pipeline within their jurisdiction.

i) **ID 87-2 (Sour Well Licensing And Drilling Requirements):** This directive replaces and consolidates a number of ID's dealing with sour wells (critical and non-critical). It also outlines the presubmission process, presubmission requirements, means of determining the H_2S release rate, the minimum separation distances for sour wells, response plan requirements, and critical well definition and drilling requirements. A graph of the relationship between the emergency planning zone and the assigned H_2S release rate is also presented.

B) British Columbia (MEMPR)

The MEMPR has issued a **"Procedural Handbook"** for the emergency response plan requirements. Circumstances involved are evaluated on a site-specific basis. The **"Procedural Handbook"** includes an outline of the pre-submission requirements and the emergency response plan guidelines (Appendices 6 and 7 of the **"Procedural Handbook"** respectively).

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4 A "susceptible" individual is one who has the disposition to be physically affected by an exposure. A "sensitive" individual is one who responds readily and intensely to an exposure. Use of broad definitions for these terms is recommended.

2.4 WHEN RESPONSE PLANS ARE REQUIRED

There are four primary factors which determine when emergency response plan are required by the regulating agency. These factors are[5]:

a) the well's classification (ie: special or non-special);

b) the presence of members of the public in the emergency response planning zone;

c) whether the regulatory agency feels the specific circumstances dictate the need for a response plan; and

d) the nature of the operation (eg: drilling, completion, servicing with the wellhead on-or-off).

A) Special Sour Well Classification

Emergency response plans are required by regulating agencies for any drilling, completion, or servicing operation where the well has been classified as "special". While most of these will be site specific, supplemental information for sour facility plans may be acceptable in certain circumstances.[6,7]

B) Population Density Considerations

The regulating agencies require emergency response plans for sour wells that have residences, public facilities, worksites, or places of business inside the emergency planning zone[8]. (See Section 4.2(A) for instructions to calculate the planning zone radius.)

C) Evaluation Of Circumstance

Emergency response plans are also required when the regulating agency deems it is in the public's best interest to have a plan prepared. In cases where there may be some doubt, consultation with the regulating agency is recommended.

Conditions which *may* warrant the regulating agency requesting a plan be prepared include:

a) recognized public concerns, whether due to public safety concerns, or an area's local issues; or

b) indications that the Operator would be unable to provide an effective response without the pre-planning process, given the infrastructure, resources, and experience available for the well in question.

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5 ERCB's ID 87-2, Section 6.3.1; ID 90-1, Section 3.2; MEMPR, Procedures Handbook, Appendix 6, Section 5.2.
6 ERCB's ID90-1, Section 3.2.
7 Refer to Section 2.5, Figures 2.1/2.2 of these guidelines for additional detail.
8 ERCB's ID 87-2, Section 6.3.1; ID90-1, Section 3.2; MEMPR, Procedures Handbook, Appendix 6, Section 5.2.

D) Nature Of The Operation

Requirements for emergency response plans will be effected by the nature of the operation being carried out. Figures 2.1 and 2.2 summarize the criteria used to determine whether or not a plan would be necessary, and if so, what type of plan would be required.

2.5 TYPES OF RESPONSE PLANS

Industry has developed three types of emergency response plan documents. They are:

a) "Sour Well Plans";

b) "Reduced Plans"; and

c) "Supplemental Information to existing facility plans".

There has been no additional breakdown for special sour wells as the detail provided for non-special and special sour wells is essentially the same. (Generally, special sour wells have additional resources dedicated and more precautionary measures taken than do non-special sour wells. Drilling or completion operation plans for special sour wells also require approval by the regulating agency.)

A summary diagram outlining the decision process is presented in Figures 2.1 and 2.2.

A) Sour Well Plan

"Sour Well Plans" are to be prepared for all sour wells requiring an emergency response plan where Reduced Plans or Supplemental Information submissions do not apply. This is the case for:

a) all special sour well drilling operations;[9]

b) all non-special sour well drilling operations that have one or more dwellings, public facilities, worksites, places of business, or similar activities within the emergency planning zone;[10]

c) completion and servicing operations for all special sour wells that cannot be covered by an approved emergency response plan for a sour facility;[11] and

d) completion and servicing operations where the wellhead is removed on any non-special sour well that has one or more dwellings, public facilities, worksites, places of business or similar activities in the planning zone, and where the well cannot be covered by an approved emergency response plan for a sour facility.[12]

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9 ERCB's ID 87-2, Section 6.3.1; MEMPR Procedures Handbook, Appendix 6, Section 5.2.
10 ERCB's ID 87-2, Section 6.3.1; MEMPR Procedures Handbook, Appendix 6, Section 5.2.
11 ERCB's ID 90-1, Section 3.2.
12 ERCB's ID 90-1, Section 3.2.

FIGURE 2.1
WHEN ARE EMERGENCY RESPONSE PLANS
REQUIRED (DRILLING PHASE)

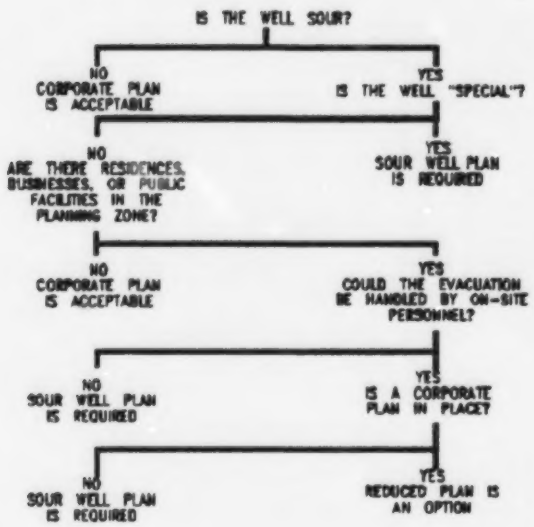
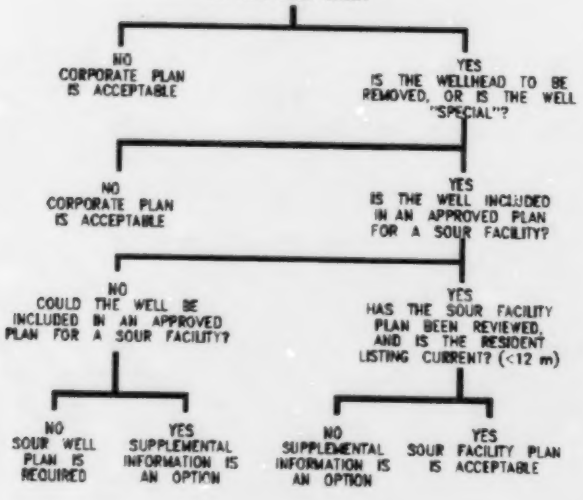


FIGURE 2.2
WHEN ARE EMERGENCY RESPONSE PLANS REQUIRED (COMPLETION AND SERVICING PHASES)
(ALBERTA ONLY, BASED ON ID 90-1)


IS THE WELL SOUR?
NO
CORPORATE PLAN IS ACCEPTABLE
YES
IS THE WELLHEAD TO BE REMOVED, OR IS THE WELL "SPECIAL"?
NO
CORPORATE PLAN IS ACCEPTABLE
YES
IS THE WELL INCLUDED IN AN APPROVED PLAN FOR A SOUR FACILITY?
NO
COULD THE WELL BE INCLUDED IN AN APPROVED PLAN FOR A SOUR FACILITY?
YES
HAS THE SOUR FACILITY PLAN BEEN REVIEWED, AND IS THE RESIDENT LISTING CURRENT? (<12 m)
NO
SOUR WELL PLAN IS REQUIRED
YES
SUPPLEMENTAL INFORMATION IS AN OPTION
NO
SUPPLEMENTAL INFORMATION IS AN OPTION
YES
SOUR FACILITY PLAN IS ACCEPTABLE

B) Reduced Plan

When an Operator has a corporate response plan, it will have the option of preparing "Reduced Plans"[13] for select, non-special sour wells. A reduced plan can be used when public evacuation and area isolation can be effectively conducted by on-site personnel who can be dedicated to response plan activities. Historical practice and direction by the regulating agencies have limited these to planning zones with four residences or less. If the on-site resources can handle situations with slightly more residences, a reduced plan may be considered. (In these situations, consultation in advance with the regulating agency is recommended.) The Operating personnel must be made aware of specific requirements and their responsibilities in the emergency response plan.

Vehicle capacity capable of handling the resident grouping would be required.

C) Supplemental Information

Information supplements to existing approved emergency response plans for sour facilities fulfill the requirements for a response plan in some completion and servicing situations. These occur when:[14]

a) the well would otherwise require an emergency response plan; and

b) when the well is to be included within the planning zone of a sour facility emergency response plan, but is not currently listed in the plan.

Where the servicing operation is on a well included in an approved emergency response plan for a sour facility, the operation will be permitted without submission of a further response plan if the following requirements are met:[15]

a) the facility response plan has been filed with and approved by the regulating agency; and

b) the response plan has been reviewed by the Operator and contains a resident list which has been updated within the last 12 months.

Section 5.3 of this guideline provides the content requirements for supplemental information submissions.

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13 See Section 5.2 for content requirements for "Reduced Plans".
14 ERCB's ID 90-1, Section 3.2.
15 ERCB's ID 90-1, Section 3.2.

3. PUBLIC CONSULTATION

Discussions with the public play an integral role in emergency response planning. Contact with the public allows the company to obtain relevant information for the emergency response plan, inform the public about the proposed project, and address public concerns.

Representatives conducting public awareness activities and resident visitations must be thoroughly familiar with the project; including the anticipated long-term impact it will have on the area. (Historically, the primary concerns raised by residents have related to whether the production would be to tanks or flowlines, and if flowlines were to be used, where the production would be produced to.) Whenever possible, these representatives should also have the authority to make decisions related to the emergency response plan during the discussions with the residents.

Companies are strongly recommended to review the **"Public Consultation Guidelines for the Canadian Petroleum Industry"**, published by the CPA in October 1989.

3.1 ISSUE IDENTIFICATION

An emergency response plan is prepared to protect the public during sour gas releases which threaten public safety. Therefore, it is essential that the public understand the steps being taken: especially those dealing with evacuation procedures.

If contact with the public is done with an attitude of cooperation and a thorough knowledge of the project, many public concerns may be effectively alleviated. (This applies to the initial resident visitations as well as to any notification required through the implementation of the plan.)

An Operator can identify public action groups by contacting the regulating agency, local government authorities, area residents, industry operators, or other local sources. It may be beneficial to open the communication lines with these groups before proceeding with the resident survey. An Operator may gain a sensitivity for local public issues and potential resistance by taking these steps. In addition to resident visits, common approaches used in developing this communication include kitchen table meetings and informal gatherings of a few residents. There may also be larger open-house meetings with formal presentations by technical, safety and community relations specialists. Personnel from government departments and the regulating agency (licencing or field office personnel) may be asked for assistance at any stage.

Discussions must be conducted in a frank and honest manner. The Operator should promote an atmosphere of cooperation at all times and keep the group(s) apprised of developments.

A) Industry Precedents

Procedures used by other operators in the area should be determined. (Existing procedures can be identified by contacting the active operators or the regulating agency.) This information will indicate the commitments made by other operators and may help in predicting local concerns. Questions on the reasons for changes in approach should be anticipated during the resident visits.

Procedures, evacuation facilities, and terminology used by other operators in the area should be used if possible. Use of consistent evacuation reception centres, alert level definitions, and public handout information on the effects of H_2S or SO_2 are examples of items which may be standardized without significant impact on a company's approach. For the larger sour gas plays, it is often possible to extend this information standardization to include H_2S release rate and gas composition for target zones.

Cases will inevitably arise when the precedents do not apply to the well in question. There will be differences in the support systems available, emergency planning zone site specifics, and existing company facilities, procedures or corporate policies. In these cases, standardization may not be possible.

B) Historical Concerns

If an Operator is unfamiliar with an area, an attempt should be made to identify local historical concerns. Once these are identified, it may then be possible to develop proactive solutions. Identification of historical concerns can also be useful in defining the licensing and approval time frame.

Consultation with the regulatory agencies, other operators, or local groups should help in defining these concerns.

C) Anticipated Concerns

Many of the public concerns could be anticipated by examining the proposed program and location. Potential concerns may occur over the noise, hours of operation, traffic, odours and safety issues. Appropriate emergency response procedures can then be developed before public contacts are made. Changes in the procedures may be required where unusual circumstances (ex: church camps, large family reunions) are subsequently identified in the public surveys.

Public concerns must be addressed. Where they cannot, the regulating agency is to be advised.

D) Area Familiarization

The planning zone area must be visited prior to the preparation of the emergency response plan.

This will assist in a proper interpretation of the map's geographical and topographical information. It will also highlight conditions which may not be readily apparent from general sources. (eg: Forestry haul roads often have one-way traffic, new roads may have been built since the map was last updated, etc.) This visit should identify rivers, bridges, roads, landmarks, residences, public facilities, and other items which may effect the plan's implementation. The site survey should consider potential weather related problems, and their effect on the ability to conduct evacuations. The survey can be conducted at the same time as the resident visits.

E) Information Exchanges Among Operators

Resident contact information must not to be obtained from secondary sources as a means of bypassing the resident visitation. Initial resident contacts should not normally be conducted by phone or through the mail.

Companies are encouraged to share information concerning emergency procedures, terminology, definitions, and area issues. Emergency response plans themselves should not be considered confidential. However, specific detailed information regarding the people within the planning zone is confidential (eg: medical and evacuation concerns). Comparing resident contact information may be considered if confidentiality safeguards are maintained. It should be limited to that required for identification of residences which need additional contact (ie: sharing of name, location, and phone number, etc.).

Each Operator is responsible for ensuring their information is current and accurate.

3.2 RESIDENT SURVEYS

Each household in the emergency planning zone must be contacted personally by a company representative. During this visit, household information will be documented and should include any information the Evacuation Coordinator may need. This information is generally considered valid for a six month period.

Households must be given a public information package. This package should identify the project, detail the procedures that the company will use to ensure public safety, and explain the effects of both H_2S and SO_2. (A sample information package is shown in Appendix 3.)

Residents who live near the planning zone, but who must travel through the planning zone to evacuate the area, are considered to be planning zone residents.

A) Preparation Of Public Information Packages

Where an Operator has developed a familiarity with the area and has a good understanding of local issues, the public information package can be prepared in advance of the resident visits. In other

cases, the Operator may feel the public information and input is required before the public information package can be prepared. When this is the case, the public information package should be mailed or delivered prior to the well entering the sour zone(s). For long duration wells, the Operator may wish to hold the final public information package until shortly before the well enters the sour zone. Benefits of delivery just prior to penetration must be balanced against those of a public that is informed of all procedures at an early stage. Some form of resident contact is recommended shortly before penetration for long duration wells.

Regardless of which approach is used, an information sheet outlining the Operator's plans, the proposed location, and a general description of the anticipated response planning issues should be given to the residents at the time of the visit. A copy of the Alberta Health pamphlet entitled, **"Guidelines For Action Regarding Hydrogen Sulphide"** may be included as it provides a well-written summary of the effects of H_2S.[1] Additional information on the medical impacts of H_2S and SO_2 should be forwarded to any resident requesting it.

Public information packages do not need approval of the regulating agency. The agency may, however, request additional information be provided if deficiencies are identified. Copies of the public information package are generally included as an appendix to the emergency response plan so the plan holders are aware of the information provided to the public. The regulating agency's local office should be provided a copy at the time the resident contacts are conducted.

B) Residential Contacts

Resident contacts are extremely important. They may be the public's first exposure to the company and are the point where the essential information transfers occur. These contacts should be handled by individuals with communication skills and non-confrontational styles.

If the Operator is intent on developing a good working relationship with the public, other steps can be taken. Individuals conducting resident visits should be well versed in the company's program, and be in a position to discuss the company's operational practises as they relate to area residents. A good working relationship is also enhanced if they have sufficient responsibility and authority to make some decisions on community related issues.

Resident questionnaires should be completed. (A sample questionnaire is included in Appendix 2). They are to include information on how residences could best be contacted during alert situations, what concerns are likely to occur during an evacuation, and whether or not there are medical or other factors which may prompt an accelerated response. While the core information will be standard across industry, many operators choose to gather additional data which may be of use. Additional information has included names and phone numbers for alternate contacts, names of family physicians, school bus scheduling and contact information, and livestock information.

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1 Environmental Health Services, Alberta Health, 7th Floor, 10030-107 Street, Edmonton T5J 3E2 Phone 427-2643

Care should be taken to only request information which will be used in the planning and implementation processes. Care should also be taken to ensure confidential resident information is not distributed excessively. It should only be passed to the personnel involved in providing a direct response, and the regulating agency.

Any concerns or objections voiced by the public must be addressed promptly. The regulating agency must be advised of any unresolved issues.

C) Urban Centres

Individual resident contacts are generally not required for urban centres within the emergency response planning zone. Contact must, however, be made with those responsible for their civil emergency disaster plan. Arrangements must be made to adequately address how the Operator's emergency response plan would interact with the civil emergency response plan. Any changes in ignition criteria or monitoring programs that are to be implemented because of the urban centres' proximity are to be outlined in the response plan.

3.3 CONFLICT RESOLUTION

Conflicts may develop between an Operator proposing to drill a sour well and members of the public who do not want the well drilled. These will likely be identified during the Operator's issue identification and resident survey processes. Information on potential approaches to resolve these conflicts is provided in the CPA's **"Public Consultation Guidelines"**. (Members of the public include residents, landowners, public interest groups, and any other individuals or groups who can show that they may be negatively impacted by the well. It is not restricted to the residents inside the emergency planning zone.)

4. EMERGENCY PLANNING PROCESS

4.1 ALTERNATIVE MEANS OF PUBLIC PROTECTION

Three fundamental approaches to providing public safety during significant releases of sour gas are evacuation, well ignition, and a request for the public to take shelter.

A) Evacuation

Evacuation is Industry's primary means of ensuring public safety during advanced alert situations. The resulting evacuation would usually remove the public from the planning zone before a release of sour gas occurs (ie: a precautionary evacuation). This may provide the Operator some flexibility in ignition decisions.

B) Well Ignition

Well ignition is the final means of providing protection when evacuation is impractical, downwind monitoring is not occurring, and/or the safety of workers or the public is threatened. These situations may occur when large populations, short time frames, or other complicating factors are encountered during a significant release of sour gas. Well ignition would convert the H_2S to SO_2, which would be dispersed from ground level by the thermal updrafts created by the combustion. (SO_2 concentrations are, as a result, generally far lower than those of H_2S, or than the evacuation level criteria.)

Well ignition does not, by itself, negate the need for continuing with an evacuation. It does, however, have an impact on the urgency of the notification or evacuation activities being carried out.

C) Shelter

Requesting the public to move indoors and close their doors and windows is a temporary means of protecting residences. This should be considered as a viable alternative in limited circumstances only. It is generally acceptable only while residents wait for transportation, or during a sour gas release of limited duration.

For drilling, completion, and servicing applications, shelter should not be considered a primary means of public protection as the sour gas release in these circumstances may be prolonged.

4.2 DETERMINATION OF PLANNING ZONE SIZE AND CONFIGURATION

The appropriate emergency planning zone must be adequate to ensure the public safety near the well. The size of the zone must reflect the maximum potential H_2S release rate, but must also have regard for the local terrain, population numbers, and their location.

A) Planning Zone Size

The size and configuration of the emergency planning zones should be determined by considering the maximum potential H_2S release rate, the physical features of the area (topography, access roads, resident locations, etc.), the population densities, and the capabilities of the response infrastructure.

The first approximation of the planning zone size will be based upon the potential H_2S release rate, as identified in the well licence application presubmission. Equations for the (calculated) emergency planning zone radius are given below. Figures 4.1 A and B are plots of these equations.

for $0.01 m^3/s < Q < 0.3 m^3/s$ $R = 2.0(Q^{0.58})km$
for $0.3 m^3/s < Q < 8.6 m^3/s$ $R = 2.3(Q^{0.68})km$
for $Q > 8.6 m^3/s$ $R = 1.9(Q^{0.81})km$

where Q = release rate (m^3/s)
and R is the EPZ radius (km)

As a general guideline, a maximum radius of four kilometres is recommended for manageability (see Section 4.2 C).

For simplicity purposes, it is recommended that response plans avoid having the active planning radius increase incrementally as additional sour zones are penetrated. The planning zone should normally be based upon the maximum potential cumulative release rate. In cases where there are serious changes in the commitments (or timing of commitments) as a result of this approach, the planning radius may be changed as each sour formation is penetrated. (This may be advantageous to avoid having a well become classified as a "special sour well" before the "special" formation is penetrated.)

Operators should be familiar with the area surrounding the planning zone. This "awareness zone" generally extends to twice the radius of the planning zone.

FIGURE 4.1A
PLANNING ZONE RADIUS (<1 m3/s RELEASE)

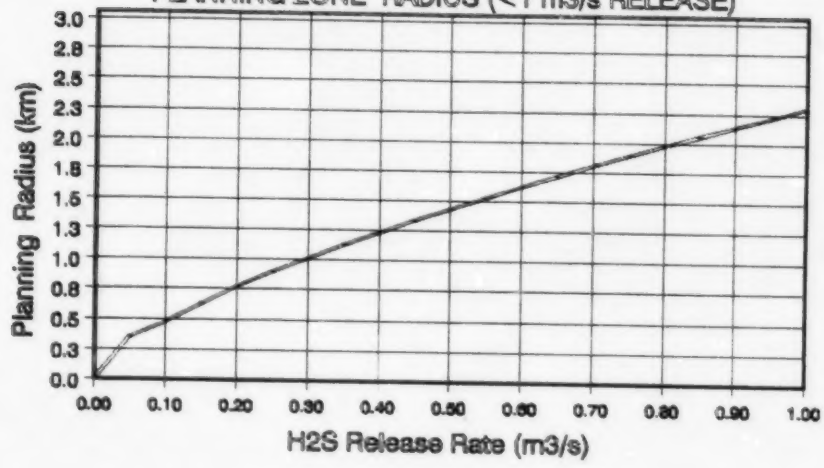
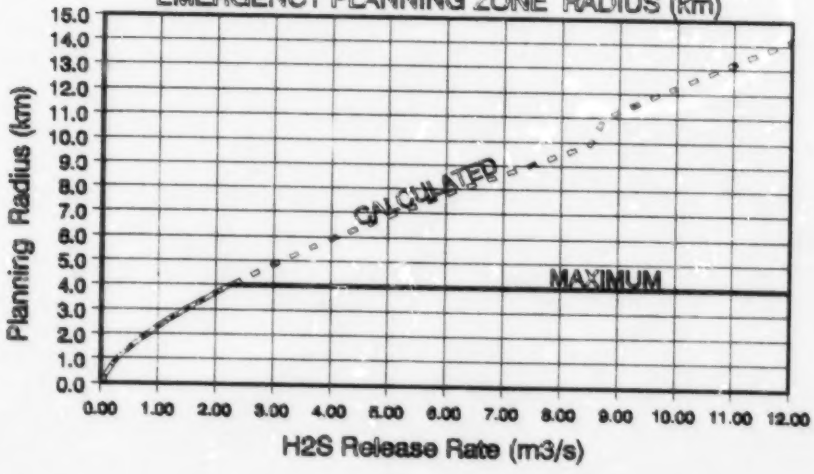


FIGURE 4.1B
EMERGENCY PLANNING ZONE RADIUS (km)



B) Planning Zone Configuration

The basic planning zone configuration is a single, circular zone. Other configurations can be used to prioritize areas and improve management capabilities.

The two most common variations are:

a) two concentric zones. The two zone arrangement has often been adopted for planning zones with a large number of residences. The inner zone (usually two kilometre radius) is protected through the use of more stringent notification, evacuation, and (in some cases) well ignition criteria. The outer zone (the outside two kilometres) generally adopts the more traditional response criteria.
Use of concentric zones provides the flexibility of developing staged and prioritized response. The Operator can then provide the residences in close proximity to the well a heightened level of attention, as well as cope with larger numbers of residences.

b) oblong shapes. Planning zone shapes may be stretched in various directions to reflect topography, isolated residence locations, urban centres, or other concerns.

Prevailing wind conditions are not generally a major consideration. Response plans must be effective, regardless of wind direction.

C) Manageability Of The Emergency Planning Zone

An Operator should examine the planning zone size, population, population density, transportation routes, geography, and topography prior to development of the emergency response plan. An assessment of the planning zone's manageability must be made. If effective control of the planning zone would not be possible, the zone should be reduced to one that can be managed. If a hazard exists beyond this manageable area, well ignition would be a primary means of ensuring public safety.

Residents beyond the designated emergency planning zone would not normally be evacuated by the Operator. While notification and evacuation is the responsibility of the local municipal authorities, the Operator may at times wish to be proactive and expand the evacuation beyond the planning zone. In this rare circumstance, the expanded evacuation may be done in conjunction with the municipal authority.

For general evacuations outside the planning zone, the Operator would provide a supportive role to the provincial authorities at their Government Main Control Headquarters (MCHQ).

Well ignition would be used to further enhance public protection if the local disaster plan could not evacuate any identified hazard areas outside the planning zone.

An area's manageability may be affected by the Operator's ability to maintain an awareness of activities within the emergency planning zone. Awareness of activities in the planning zone should

be maintained; either by regular wellsite traffic or by conducting a transient survey. These surveys should be updated as soon as is possible after a Stage One Alert has been called.

D) Multiple Well Program

Emergency response plans can be developed for multiple well programs. These plans must, however, provide site specific information for each of the wells involved. Common procedures or infrastructures can, however, be provided once for the entire program.

4.3 ORGANIZATIONAL INFRASTRUCTURE

During advanced stages of response, activities will be carried out at a number of locations. Coordination of these activities will require the establishment of control points (eg: On-scene Command Post, Government MCHQ). The actual organization of these control points will vary from Operator to Operator. It will also be dependant upon company procedures, which control points are in place, and the staffing available for each control point.

A) Government Main Control Headquarters (MCHQ)

Provincial emergency procedures call for a government response coordination centre to address the inevitable public and media demands for response from the Government agencies. This centre, referred to by Alberta's ERCB as the Government Main Control Headquarters (MCHQ), is to be managed jointly by the regulating agency and the authorities responsible for public safety. The Operator's key contact in the Government MCHQ will, however, be the regulating agency's representative.

Alberta has developed an emergency response plan for sour gas releases. This plan is available from either the ERCB or Alberta Public Safety Services. It outlines the structure and operation of the MCHQ.

The Government's intention is to provide support and resources as required by the Operator; not to take control of the emergency. The ERCB has, however, the authority to take charge of the situation if the Operator is not available, or in the ERCBs' view, responds improperly or has insufficient resources. Government officials are there to provide guidance dealing with health, agriculture, evacuation, and government policies.

There are two primary functions provided by the Government MCHQ. First is coordination of government activities related to the emergency situation. A wide range of issues can be addressed (examples include effects of H_2S on agriculture, livestock, or people) as there will be representatives from many government agencies based at the Government MCHQ. The regulating agency will coordinate the various agencies at the Government MCHQ.

The other primary function is to provide a coordinated and consistent flow of information to members of the public and media. This will allow public concerns and questions to be addressed quickly. Procedures are in place to establish frequent media updates on the situation and response.

If evacuation outside the emergency planning zone is necessary, the Government MCHQ, in conjunction with the local authorities, will normally be responsible for coordinating evacuations in this area. This will include the area between the actual emergency planning zone radius and the calculated radius. This does not absolve the Operator of its overall responsibility to continue to provide resources.

The Government MCHQ would be organized under the direction of the regulating agency. It generally would not be established until a Stage Two Alert. For smaller Operators in particular, the Government MCHQ would be in a position to provide a pool of technical experts that the Operator may draw on to assist in dealing with the well control, public health, or evacuation issues.

MCHQ facilities have two components. The government agency and Operator representatives are located in a control centre; a Public-Media Inquiry Room (PMIR) is established to handle large numbers of telephone enquires from the public, and a debriefing room is provided for in another room.

As the Government MCHQ will establish a focal point for both the public and the media, it is essential that the Operator has representation at this location. It is recommended that the Operator send a team to the Government MCHQ to address corporate, public/media, and technical issues. It should also be noted that key operating decisions will not be made at the Government MCHQ unless the Operator is incapable of dealing with the incident effectively.

B) Operator's Emergency Operations Centre

The Emergency Operations Centre will coordinate the Operator's overall response activities within the emergency planning zone. The Operator's senior personnel will operate from the Emergency Operations Centre (probably the head office). It will support the On-scene Command Post, as well as the Off-site Control Centre.

The Operator assumes the lead decision-making role for response activities within the emergency planning zone. If the Operator does not, or can not, provide satisfactory response, the lead role will be assumed by the regulating agency representative at the Government MCHQ.

C) Off-Site Control Centre

An Off-Site Control Centre is an operations centre established outside the immediate vicinity of the gas release. The Operator's evacuation, area isolation, and evacuation reception decisions would

be made at this centre. Possible locations are the rig camp, local field office or gas plant control rooms. It would be established if the emergency situation is expected to become too hazardous to manage on-site, or if the public safety activities are being managed by personnel located off-site. (Other common terms used for the Off-Site Control Centre are Emergency Control Centre or Remote Command Post.)

The Off-site Control Centre is used to coordinate the Operator's local, off-site emergency response plan activities within the emergency planning zone. It will generally be headed by an Evacuation Coordinator, who shall report to the Operator's head office or to the On-Scene Commander. If the government MCHQ and the Operator's Emergency Operations Centre not at the same location, Communication ties would be maintained with the MCHQ. This would be necessary as the information obtained from the air quality monitoring program must be passed to the provincial Department of the Environment. The Evacuation Coordinator must communicate with the Government MCHQ to ensure the Department of Environment's monitors complement the data collection. (The Department of Environment must have complete access to all air quality data collected.)

The air quality monitors brought into the area by the Department of Environment will be controlled at the Government MCHQ by the Department of Environment.

Air quality monitors are not to be restricted in their movements by the location of the emergency planning zone boundaries.

D) On-scene Command Post

The On-scene Command Post will be the operations centre established by the Operator at the wellsite. The On-Scene Command Post's primary function will be to manage the well control procedures. If there is no Off-site Control Centre, responsibilities for coordinating roadblocks, public evacuations, and air quality monitoring within the emergency planning zone will often fall with the On-Scene Command Post.

Regardless of how the reporting relationships are structured, they should be described in the response plan.

The regulating agency and Occupational Health and Safety (or equivalent) are the two government agencies expected to have representatives at the On-Scene Command Post. Of these, only the regulatory agency's representative is expected to be involved with the emergency response plan and public safety issues. (The primary responsibility for the Occupational Health and Safety representative will be employee safety, and not public safety.) The regulating agency's representative will report to their representative at the MCHQ.

The On-Scene Command Post activities will be coordinated by the Operator's Wellsite Supervisor acting as the "On-Scene Commander". This position is given the authority to take whatever steps

are felt necessary to ensure public or worker safety. This authority extends to well ignition. It is generally understood that the ignition decision would be made in conjunction with regulatory authorities and the Operator's management, *if time permits*.

E) Evacuation Reception Centre

The Evacuation Reception Centre is a predetermined facility where the public are asked to register once they have been evacuated. The Operator should be prepared to receive the evacuees at the centre as they arrive. (For wells with a small number of residences in the emergency planning zone, the Evacuation Centre does not have to be predetermined.)

The Evacuation Reception Centre does not have to have accommodation facilities, as registration can be independent of housing issues. The centre should also be located well outside the emergency planning zone.

4.4 DEFINING RESPONSE LEVEL CRITERIA

Industry has adopted three response levels. Accepted criteria used to initiate these response levels are:

Stage One (Potential Emergency): is a precautionary alert called when the sour zone is open and an event occurs that has the potential to lead to a well control problem;

Stage Two (Emergency): signals that response to an imminent or current release of sour gas is necessary. Indications are that, while the problem will most likely be resolved in the short term, immediate action should be taken to protect the public during this period. This level could occur if wellsite personnel are unable to safely shut the well in;

Stage Three (Major Emergency): occurs when well control is unlikely in a short time period and/or there is an uncontrolled flow containing sour gas.

Examples of conditions which may trigger these situations are:

Stage One (Potential Emergency): the sour horizon is open and the well is encountering a significant loss of circulation, significant continuous gas cut mud, or a significant kick;

Stage Two (Emergency): an equipment malfunction which threatens well control occurs while circulating out a kick; or the circulation material loss rate exceeds mixing capacity or supply;

Stage Three (Major Emergency): there is an uncontrolled flow of sour gas from the well (ignited or unignited).

For clarification purposes, odour complaints or small releases of sour gas from thief hatches (ie: non-flow situations) would not generally constitute a Stage One Alert. (Complaints are to be investigated, but would not by themselves create a Stage One Alert.) Operators should consider development of procedures to deal with low volume "nuisance" releases of sour gas that do not

constitute an alert situation. Likewise, any uncontrolled flow, whether unignited or not, would be considered a Stage Three Alert.

Definitions should provide some flexibility to the on-site personnel in determining the appropriate alert level for a given situation. When there may be some uncertainty in the alert level, consultation with the regulating agency is recommended.

The response actions outlined in the emergency response plan are to be considered commitments for actions the Operator is to carry out. If circumstances warrant a change in implementation of these plans, revisions may be possible providing the regulating agency has been consulted and agrees to the changes. Commitments made to the public and the corresponding sensitivities must be considered when a request for deferment is made.

4.5 ALERT LEVEL RESPONSES

A) Response Team, Support Service, And Government Agency Notification

Individuals who assist with a Stage Two response are to be notified of a Stage One Alert. This notification should extend to all members of the Operator's response team (Evacuation Coordinator, Phoners, Evacuation Crews, Roadblock Crews, and Evacuation Reception personnel), the regulating agency, and key service companies required at a Stage Two Alert.

The regulating agency must be advised of all alert levels so that they can implement the government notification fan-out. Likewise, the local police department (usually the RCMP) the local public safety authority should be advised, as they often are the first agencies the public contact for information. They also benefit from early notice as it allows them to prepare for subsequent levels, should the emergency escalate.

B) Resident Notification

The point at which the public are contacted during alert situations must be identified in the emergency response plan. It should be determined if there are any practical benefits to an early notice which would compensate for the likely distress such a call would create. Situations which are most likely to benefit from an early notification are those with medical concerns, high popu ation densities, or residences with limited egress, egress close to the well, or those in close proximity to the well. In situations where residents are visibly uneasy with the prospect of a sour well in their area, an Operator may wish to obtain their direct input on what stage of alert notification is to occur.

The Operator should have the flexibility to exceed the Stage One response without triggering the next alert level. (ex: An Operator may wish to evacuate the public at a Stage One Alert level, even though the approved response plan has evacuation at a Stage Two Alert. By taking this proactive move, the Operator is not to be committed to the remaining Stage Two Alert level responses. The

regulating agency must be advised of any precautionary evacuations.)

Public (residents, transients, and businesses) notification at Stage Two would be a minimum requirement as an alert to possible evacuation.

When using concentric zones, inner zone residents are usually notified at a Stage One Alert level. Resident notification for the outer zone is usually at Stage Two; although a Stage One notification may still be appropriate in some cases.

It should also be noted that selective resident notification should be handled with caution. Residents who are not contacted, while others around them are, may not understand the omission. The Operator may wish to expand the precautionary contacts at times to address this issue.

To notify the public effectively, they must be contacted quickly and given the information needed to respond. Prepared evacuation and notification messages will help. (Appendix 2.)

Training and care in selecting Evacuation Crews and Phoners are needed to ensure emergency messages are communicated effectively. Response planners should also attempt to ensure the sense of urgency transmitted by the messages *and their tone of voice* reflects the situation.

C) Evacuation And Area Isolation

Evacuation is usually initiated at a Stage Two Alert level. As with the other aspects of planning, a universally prescribed evacuation criterion cannot be provided as the need to evacuate will vary from well to well. Area evacuation at Stage One is generally not provided for except in cases where there is an inner planning zone. Company policies, well conditions, site-specific conditions, public requests, or other considerations may, however, dictate evacuation at this preliminary stage.

While there are no definitive criteria, a precautionary evacuation may be considered during a Stage One Alert for selected individuals who:

a) are "medical susceptibles"; or
b) would have difficulty in evacuating in a timely manner; or
c) have requested to be evacuated as a result of the alert.

The emergency planning zone's mandatory evacuation criteria are based upon the alert level being called and available air quality monitoring data. It generally includes:

a) Stage Two Alerts for single zone planning zones; or
b) Stage Two Alerts for any inner most planning zones in multiple zone response plans; or
c) Stage Three Alerts for the outer planning zones in multiple zone response plans; or
d) any situation where ambient concentrations of H_2S of 20ppm (averaged over a

three minute period) are being recorded;[1] or

e) consideration for situations where ambient concentrations of H_2S of 10ppm for 8 hours or more are being recorded.[2]

Individual voluntary evacuation are to be considered when:

a) concentrations are below 10ppm (for susceptible individuals who have health symptoms that are persisting or becoming more severe); or

b) any individual has health symptoms develop; or

c) any situation where ambient concentrations of SO_2 of 5ppm averaged over a 15 minute period, or 3ppm averaged over a three hour period, or 0.3ppm averaged over a 24 hour period, are being recorded.

Roadblocks are established at the time an evacuation is called. As a result, they would not usually be in place during a Stage One alert.

Evacuations by an Operator are not enforceable unless the proper authority is granted. This is obtained through an FH order, or a declared State Of Emergency. An FH Order (Fire Hazard Order) is issued by the Regulatory Agency, restricts access, and can be obtained quickly. The State Of Emergency is called by the Municipal Authority. Evacuations should also include a "Notice To Airmen" (NOTAM). Transport Canada will use a NOTAM to advise pilots of a restriction to the airspace above the planning zone. (NOTAM's are generally requested by the regulating agency at a Stage Two or Three alert.)

Once the emergency planning zone has been evacuated, the Operator must recognize that there will be requests to reenter the planning zone by evacuees wishing to attend to their homes, livestock, pets, or other animals. Should the Evacuation Coordinator feel that this can be accommodated safely, arrangements are to be made at that time. These arrangements are to include an escort by a trained representative of the Operator, equipped with breathing apparatus and hand-held gas monitors. They will not be provided if the Evacuation Coordinator feels public safety would be compromised in any way.

Care should be taken with public notification to ensure residents are not unnecessarily stressed. This is especially true in situations where the evacuation is precautionary. (Examples: evacuation prior to sour gas releases, evacuations well upwind of the wellsite, or area evacuations which occur after the well has been ignited).

Evacuations may require the use of helicopters, transient surveys, or other non-conventional means of locating and contacting members of the public. While helicopters provide a valuable tool in the area search, alternatives should be considered for the periods when limited visibility, darkness, weather, or other flying conditions make overflights infeasible. Transient surveys are helpful in developing an awareness of the potential problem areas in area evacuations, and should be

1 ERCB's IL 89-15, Section 4.
2 ERCB's IL 89-15, Section 4.

conducted regularly (during normal sour operations) on wells where locating transients may be a problem.

Special arrangements may be required for evacuation of public facilities. Should large numbers of people be involved, assistance with transportation (eg: school buses) or changes in the normal notification procedures may be required.

D) Well Ignition

Well ignition is the final means of providing protection when evacuation is impractical, downwind monitoring is not occurring in the hazard area, and/or the safety of workers or the public is threatened. Authority to ignite is maintained on-site by the On-Scene Commander, and is to be exercised only when the On-Scene Commander believes the safety of the crew or members of the public is potentially at risk.

Ignition decisions will, when time permits, be made in conjunction by the On-Scene Commander, the Operator's Emergency Operation Centre, and the regulatory agency's representatives (both at the On-Scene Command Post and the Government MCHQ). To the degree the evacuation has been successful, the pressures for premature ignition will be lessened. Ignition criteria will depend on the circumstance, but will generally be concentrations averaging 20ppm averaged over 3 minutes in Alberta, or 15ppm over 15 minutes in British Columbia. If there are average concentrations greater than 1ppm over one hour in urban centres or unevacuable areas, the Operator must consult with the regulating agency on the ignition question. The rational for using the 1ppm concentration as a decision point is that 1ppm is what the municipalities argreed to when they are consulted by the ERCB for approval to allow the well licence application to proceed.

It is optional to include documented well ignition procedures in the emergency response plan. The procedures must, however, be available on-site.

E) Downgrading Alert Levels

Once a situation improves, the downgrading of the alert level should be formalized. This decision is to be made by the Operator's Emergency Operations Centre, in consultation with the regulatory agency and the provincial Public Safety Services.

4.6 RESPONSE TEAM CAPABILITY AND EQUIPMENT REQUIREMENTS

A) Equipment Listings

Proper implementation of an emergency response will require the use of a wide range of safety equipment. While an Operator may wish to list it in the response plan, it is not required. This list

should, however, be available for the safety company.

This listing could include:

a) communication equipment (numbers and types of radios, with frequencies). Radio communication with the Evacuation Coordinator will be required for each roadblock, members of the evacuation crew, and mobile monitor. Likewise, if helicopters are to be used, some means of communicating with them should be available; and

b) roadblock kits, including maps (with roadblock locations marked), monitors, flashlights (with batteries), breathing apparatus, vests, and record sheets;

c) the number of monitors, breathing apparatus, and radios for response personnel in the planning zone; and

d) flare guns.

B) Evacuation Coordinator

All emergency response plans require an individual be designated the responsibilities for coordinating the public safety emergency response actions, as outlined in the well's emergency response plan. The "Evacuation Coordinator" may have other individuals reporting to him/her. These personnel would be responsible for telephone notifications, house calls, evacuation reception area isolation, and coordination of the Operator's mobile air quality monitors.

The Evacuation Coordinator will work closely with the drilling or completion personnel responsible for regaining well control. This close association should permit rapid and appropriate decisions on area evacuation, utilization of resources, or well ignition.

The Evacuation Coordinator must maintain a list of those contacted, their whereabouts, and how to contact them if they are not at the evacuation centre.

C) Telephoners

There must be individuals (and backups) assigned the "Phoner" responsibilities if the telephone is the primary means of resident contact. These individuals are to be available during any period in which the emergency response plan is in effect. While there is no restriction on their location, nor specific technical background required, they must be familiar with their telephoning duties and have appropriate communication skills. In cases where there are a number of phoners involved, a "Telephone Coordinator" may be required to provide an effective information transfer from the Phoners to the Evacuation Coordinator.

If there is no immediate hazard, the telephoner must be able to convey the message that the notification or evacuation is a precaution only. Likewise, if there is a hazard or alert, a controlled sense of urgency must be the message that comes across.

Each Phoner is to have a manageable resident size of telephone list. In most cases, this will be seven or less contacts. In specific cases, the phone lists may be expanded slightly.

Telephone listings provided to each Phoner should be organized in a prioritized manner. While the most common priority rankings are based upon distance from the well or medical concerns, other factors may be more appropriate in specific situations.

Efforts should also be taken to ensure that priority contacts are shared among Phoners. This will prevent the situation where one Phoner has a large number of priority calls to make while other Phoners are making calls which could safely be delayed. One means of developing this distribution is by dividing the planning zone into pie-shaped segments.

Prepared notification and evacuation messages are also to be provided. They should be updated by the Evacuation Coordinator before the notification begins. Sample copies of the notification and evacuation messages are provided in Appendix 2.

D) Evacuation Crews

Evacuation Crews are to be available to visit any residence which cannot be contacted by the Phoners, or where the public requires evacuation assistance. These crews are generally made up of on-site personnel, production personnel (if the Operator has them in the area), or safety company personnel. The Operator may wish to consider visiting each residence during an evacuation to confirm that the location has been vacated. Evacuation Crews should also pay particular attention to transient locations identified in the transient surveys.

Evacuation crews require communication capabilities with the Evacuation Coordinator. They should also be equipped with air quality monitoring devices and breathing apparatus and are to be provided with data on the emergency planning zone and resident contact information. Many Operators also provide the Evacuation Crews with pre-printed notification and evacuation notices. These notices can be left on the doors of unoccupied residences.

Evacuation Crews do not have authority to enter the homes when residents are not present.

E) Roadblocks And Security

Roadblock locations are to be identified on the emergency planning zone map. They should be labeled to allow reference to specific locations. Industry has developed a common practice of physically marking roadblock locations prior to penetration of the sour zones in order to familiarize on-site personnel with their locations.

Roadblock duties will be required to secure the evacuated area. These duties must be assigned to company representatives; whether they are on-site personnel, area production personnel, or

contractor/service company personnel brought into the area.

RCMP or other policing jurisdictions should not be expected to man roadblocks except on main highways. Manpower restrictions, a lack of training with respect to H_2S safety, and a lack of the appropriate safety equipment make reliance on the police for roadblock duties inappropriate. They should be expected to provide some assistance in maintaining area security and enforcing area closures.

Police are not to be expected to enter an emergency planning zone nor man a roadblock location without assistance from personnel trained and equipped to deal with exposures to sour gas.

Roadblocks on any one or two digit numbered highways should be established in consultation with the provincial transportation department. Roadblocks on three digit numbered highways are to be established in conjunction with the local county or municipal authority.

F) Evacuation Reception Centre

An Evacuation Reception Centre should be established for the evacuated public. This centre is to provide the registration function required to record the location and condition of evacuees. Records must be maintained by the Operator to help reunite separated families. They will also allow the Operator or the regulating agency to determine the residents' whereabouts. This will be important when status updates become available.

Evacuation Reception Centres do not necessarily have to be the point at which accommodation and lodging is provided. If accommodation and lodging can not be provided by facilities near the Evacuation Reception Centre, assistance can be obtained from the provincial disaster services department. They will also provide assistance in management of the Evacuation Reception Centre if requested.

Evacuation Reception Centres should be in a position to deal with the preliminary details of compensation. (Compensation guidelines have been developed, and are outlined in the ERCB's IL 89-20.)

G) Air Quality Monitoring

Air quality monitors will be required where concentrations of H_2S or SO_2 must be measured. This includes measurements to determine if H_2S or SO_2 is present, whether the H_2S concentrations are below established evacuation or ignition criteria, and identification of plume locations. (Roadblock Crews would use the readings to determine if they should relocate farther from the well. Evacuation Crews would need monitors to identify exposure concentrations.)

Hand-held monitors are sufficient for all worker and public safety measuring requirements. When

physical records of the measurements are required for evacuation/ignition decisions, mobile air quality monitors are necessary.

Mobile air quality monitors are normally not required in the planning zone during regular operations. They would, however, usually be mobilized in response to a Stage One Alert as a precautionary measure to prepare for a potential release of sour gas. (The regulating agency may be requested for a deferment of the mobile air quality monitoring requirements if poor access roads throughout the planning zone prevent monitor deployment.)

Operators may wish to consider deployment of air quality monitors as a precautionary measure for special sour wells in populated areas when these areas are extremely remote from air monitor service companies.

For wells with a high H_2S release potential and an emergency planning zone that includes all or a portion of an urban centre, continuous mobile monitors will be required on lease during the drilling, servicing, or completion of the potential sour zones. Need for continuous monitors for other sour wells is to be reviewed on a site-specific basis.[3]

Coordination of all information obtained from the monitors, including those being directed by the Operator, is to be provided by the provincial Department of Environment.

4.7 MAPPING REQUIREMENTS

Emergency response plan maps (regional and planning zone maps) have two primary purposes. Regional maps must provide clear directions to the general area. Planning zone maps would then be used for directions and reference inside the planning zone. (Planning zone maps should cover an area at least twice the radius of the planning zone.)

Planning zone maps must include:

a) the well location, name, and access road;
b) the planning zone(s), and planning zone radius (radii);
c) residence locations and reference numbers;
d) primary, secondary, local and access roadways. Dead-ends should be marked;
e) lakes, rivers, streams, or other waterways which may act as barriers or landmarks;
f) campgrounds, churches, schools, hospitals, or other public facilities;
g) railways or airports;
h) corporate boundaries;
i) a legend, scale, and north indicator; and
j) roadblock locations.

3 ERCB's ID 87-2, Section 6.3.4.

Public facilities, urban centres within twice the planning zone and roadways out of the planning zone should be clearly indicated on the planning zone map. Operators may consider local landmarks, topography, wellsites, and driveways to individual residences options worth including.

The map scale is to be determined by the Operator. It should be sufficient for a clear representation of the entire mapped area. Many of the details need not be provided for the area outside the planning zone. Principle exceptions deal with public facilities, roadways and rivers. For large or complex planning zones, wall maps should be considered. When wall maps are provided, Operators may find it useful to maintain reduced copies in the plan for those who operate from vehicles or other confined quarters.

Regional maps and planning zone maps may be the same if access routes from recognizable reference points are included.

The MEMPR in British Columbia has requested the regional maps at a 1:250000 scale, and the planning zone maps at a 1:20000 scale.

5. PLAN CONTENTS

Emergency response plan documents must be clear and concise. The amount of detail provided should reflect the complexity of the response and the information required by those implementing the plan.

Three formats have been developed. The first format is referred to as a "Sour Well Plan" or a "Site Specific Emergency Response Plan". It is a stand-alone document with sufficient detail to explain how a support organization would respond to an alert.

The second format is the "Reduced Plan". Reduced plans are documents that have been prepared for non-special sour wells with a small number of residences in the planning zone (generally four or less). The amount of detail provided is kept to a minimum as the response is a simple one; on-site personnel will contact and evacuate residences. As the response is handled by on-site personnel. the detailed infrastructure and support issues do not develop. They are to be used in conjunction with Corporate Emergency Response Plans.

Supplemental Information Submissions are the third format. These submissions are intended to supplement information provided by existing sour facility emergency response plans, and are for use in the completions or servicing operations only. (Detailed procedures are provided by the sour facility plan, and the site specific information is provided by the supplemental information.)

5.1 SOUR WELL PLANS

Sour well emergency response plans require:

a) the plan's distribution list;

b) relevant information on the field operations program (ie: drilling, completions, servicing), including key dates and the anticipated flow potential;

c) area maps and information;

d) alert definitions and response descriptions. A summary action chart should be included;

e) an explanation of how the response resources are organized. A reference to the government response plan and an indication of how it would be involved is appropriate;

f) evacuation and ignition criteria;

g) key contacts and phone numbers for the company, regulating agency, relevant government departments, and support services; and

h) an organized summary of the resident information obtained, as well as a statement describing the resident contact information collection process.

A) Introduction And Summary

Distribution lists should be presented near the front of each plan. When the operations are finished, each party on the distribution list should be contacted and asked to return or destroy their copy of the plan.

Each plan should begin with a summary of the key facts from that plan. The following information should be included:

a) the location of the well (relative to the nearest town);

b) the legal description and name of the well;

c) the potential H_2S release rate and concentration;

d) the expected spud or rig-up date, date of entry into the sour zone, and time in the sour zone;

e) the planning zone size and configuration;

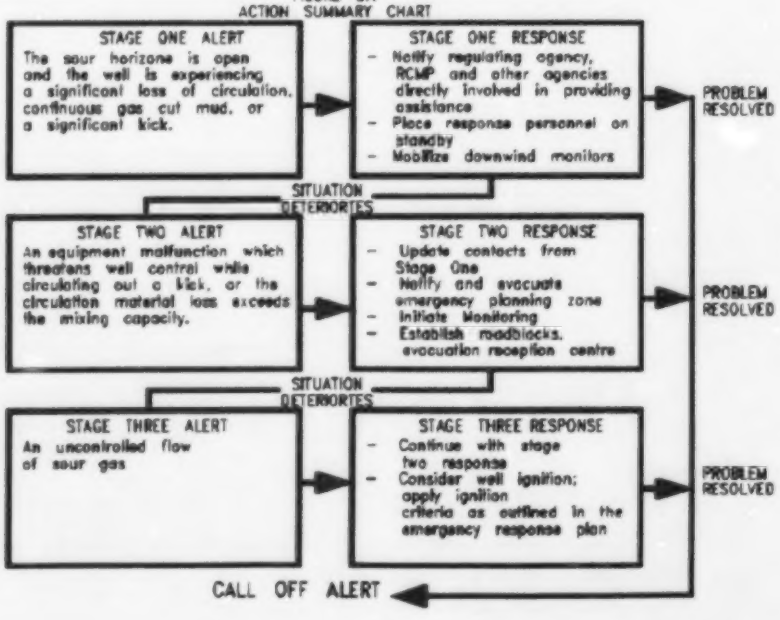
f) the general land use and population density in the area (number of residents, public facilities, roads, type of land use, etc.);

g) the prime contacts inside company (24 hour numbers); and

h) the regulating agency's local office number.

An action summary chart or point form outline which gives the stage definitions and corresponding responses (similar to that shown in Figure 5.1) should also be provided. This summary should include the key responsibility assignments, as well as descriptions of what alert level these responsibilities occur.

FIGURE 5.1
ACTION SUMMARY CHART


STAGE ONE ALERT
The sour horizone is open and the well is experiencing a significant loss of circulation, continuous gas cut mud, or a significant kick.
STAGE ONE RESPONSE
- Notify regulating agency, RCMP and other agencies directly involved in providing assistance
- Place response personnel on standby
- Mobilize downwind monitors
PROBLEM RESOLVED
SITUATION DETERIORTES
STAGE TWO ALERT
An equipment malfunction which threatens well control while circulating out a kick, or the circulation material loss exceeds the mixing capacity.
STAGE TWO RESPONSE
- Update contacts from Stage One
- Notify and evacuate emergency planning zone
- Initiate Monitoring
- Establish roadblocks, evacuation reception centre
PROBLEM RESOLVED
SITUATION DETERIORTES
STAGE THREE ALERT
An uncontrolled flow of sour gas
STAGE THREE RESPONSE
- Continue with stage two response
- Consider well ignition; apply ignition criteria as outlined in the emergency response plan
PROBLEM RESOLVED
CALL OFF ALERT

B) Area Information And Maps

Area information and maps must be included. Area information required can be restricted to items which may impact evacuation or ignition decisions (eg: poor roads vs. high quality all-weather roads; extensive use for outdoor recreation vs. agricultural; populated vs. remote). Area and regional maps should be considered. Mapping requirements are discussed in Section 4.7.

C) Stages Of Alert And Response

Response plans must contain clearly defined stages of alert and detailed responses. Response descriptions should indicate the activities to be carried out and the individuals responsible for the activities for each alert stage.

The Operator must indicate how the public would be notified and/or evacuated.

D) Infrastructure

The Operator should include a description of its response organization. This will assist non-company personnel in determining how to work effectively with the Operator. Descriptions should include the identification of the response control points (eg: On-Scene Command Post, Emergency Operations Centre, the Government MCHQ, etc.) and identify the individuals in charge of them.

The Operator should identify the key decision makers names, positions, and backups where possible. Their responsibilities are also to be explained.

E) Evacuation And Ignition Criteria

Evacuation and ignition criteria are to be clearly defined. Particular consideration is to be given to those cases where the size of the emergency planning zone has been reduced because of population density. Response plans should also indicate the positions assigned the responsibility for evacuation and ignition decisions.

F) Support Information

A listing of the residents, company personnel, and government agencies that could be contacted in the event of a sour gas release is to be provided. Additional emergency contact information for service companies and emergency support services must also be included. Emphasis should be placed on required services for emergency response planning issues. Safety companies, helicopter services, media or community relations assistance, and other key services should be included.

A copy of the public information package that was left with the residents within the emergency planning zone should be included. This will allow emergency response plan implementors to

become aware of the messages given and commitments made to area residents.

5.2 REDUCED PLANS

A) Introduction And Summary

The front page of a reduced plan should show its' distribution list. When the operations are finished, each party on the distribution list should be contacted and asked to return or destroy their copy of the plan.

Each plan should begin with a summary of the key facts from that plan. The following information should be included:

a) location of the well (relative to the nearest town);

b) legal description and name of the well;

c) potential H_2S release rate;

d) expected spud date, date of entry into the sour zone, and time in the sour zone;

e) planning zone size and configuration;

f) general land use and population density in the area (number of residents or transients, public facilities, roads, type of land use, etc.);

g) prime contacts inside company (24 hour numbers); and

h) regulating agency's local office number.

A summary chart which outlines the stage definitions and corresponding responses should also be provided.

B) Area Information And Maps

A map of the planning zone must be included. It must have sufficient detail for on-site personnel to locate the planning zone residences, as well as indications of where the roadblock locations will be. Area and regional maps should be considered. Mapping requirements are discussed in Section 4.7.

C) Stages of Alert And Response

Reduced plans must contain clearly defined stages of alert and responses. Response descriptions should indicate the activities to be carried out and the individuals responsible for these activities.

Detail on the response infrastructure, notification, or evacuation procedures is generally omitted. This is a result of the response being handled by individuals on-site. Likewise, details on communication procedures or equipment listings is omitted.

D) Infrastructure

Response plans should indicate who is assigned the responsibility for the evacuation decisions. They should also describe who will be assigned the public notification and evacuation duties on-site, and explain how public notifications or evacuations would be carried out with non-essential wellsite personnel. The commitments made for vehicles and manpower that are to be made available for resident evacuations are to be listed.

Additional detail on the Operator's emergency response structure and the involvement of government agencies is to be provided in the Corporate Plan.

E) Evacuation And Ignition Criteria

Reduced plan's evacuation and ignition criteria are to be clearly defined. Response plans should also indicate who is assigned the responsibility for the ignition decisions.

F) Support Information

A listing of residents, company personnel, and government agencies that could be contacted in the event of a sour gas release is to be provided. Additional emergency contact information for service companies and emergency services must also be included. A copy of the public handout may be attached.

5.3 SUPPLEMENTAL INFORMATION FOR COMPLETION OPERATIONS

Supplemental information is to be filed with the regulating agency for completion and servicing on all special sour wells, and for all non-special sour wells when the wellhead is removed when the wells are to be included within the planning zone of a sour facility emergency response plan, but are not listed in the plan. Supplemental information should include:

a) the location of the well;

b) the maximum H_2S release rate of all zones capable of flow;

c) a list of residents within the emergency planning zone; and

d) a map showing the location of the well, the boundary of the emergency planning zone, and the location of the residences.

APPENDIX ONE - RELEVANT GOVERNMENT REGULATIONS

Alberta

The ERCB establishes policies through the use of General Bulletins (GB's), Information Letters (IL's), and Interim Directives (ID's). Key policies related to emergency planning issues are presented below.[1]

a) ID 90-1 (COMPLETION AND SERVICING OF SOUR WELLS, Amending IL 84-9):

- Companies conducting completion or servicing operations must evaluate all wells with respect to the potential for H_2S release;
- Critical wells completion or servicing operations involving the removal of the wellhead will not be permitted without prior consent of the Board. Well maintenance where the wellhead is not removed at critical sour wells does not require prior Board approval;
- If there is a release of H_2S, the health and safety of the public must be protected either by their evacuation from the area or, if evacuation is not practical, by ignition of the well;
- Where the sour well is included in an approved emergency response plan for a sour facility, the servicing operations will be permitted without submission of a further response plan if the facility response plan has been filed with and approved by the Board, and if the response plan has been reviewed by the Operator and contains a resident list which has been updated within the last 12 months;
- Where the sour well cannot be included in an approved emergency response plan for a sour facility, completion and servicing operations will require a site specific emergency response plan;
- Supplemental information is to be submitted for all critical wells, and all non-critical wells where the wellhead is removed when the wells are to be included in the sour facility plan, but are not now listed in the plan;
- Once the supplemental information has been filed and approved by the Board the Operator may proceed with his operations;
- Site-specific emergency response plans must receive approval from the ERCB prior to conducting operations at the well;
- A copy of the approved site-specific plan or facility response plan with the supplemental information must be on-site during all completion or servicing operations where the wellhead is removed and the sour zone is exposed;
- A continuous mobile monitor will be required in the planning zone when the emergency planning zone includes a portion of, or is immediately adjacent to, an urban centre. The Board upon application may waive the requirement for the continuous mobile monitor. Waivers should be submitted with the application for completion and servicing operations.

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1 (Note: not all of the policies or detail are presented below. Should this be required, please refer to the IL's and ID's directly.)

- All critical wells must have dual well ignition systems at the well during all completion or servicing operations where the wellhead is removed and the sour zone is exposed. The Board may waive this requirement if the consequences of delayed ignition are considered minimal. Waivers should be submitted with the application for completion and servicing operations.

b) IL 89-20 (COMPENSATION IN CASE OF WELL BLOWOUT)

- A three tier approach for categorizing damages has been developed to facilitate fair and prompt compensation for people directly affected by the release of H_2S and/or SO_2. Tier I deals with the immediate out-of-pocket costs related to a justifiable evacuation from an individual's normal residence. Tier II costs are those directly related to the uncontrolled release of H_2S or SO_2 (caring for buildings, livestock, damage to equipment, etc. during the period of the evacuation period). Tier III deals with longer term impacts where cause and effect are not clear.
- Payment for Tier I and II costs are to be made directly by the Operator wherever possible. Claim forms and information packages are to be provided to residents at the Evacuation Reception Centre.
- Four recommended means of resolving claim disputes are through negotiation, mediation, arbitration, and litigation.

c) IL 89-15 (EVACUATION AND IGNITION FOR SOUR WELLS, Superseding IL 88-14):

- If there is a release of H_2S, the health and safety of the public must be protected either by their evacuation from the area or, if evacuation is not practical, by ignition of the well;
- Evacuation of the public outside the emergency planning zone would be handled in accordance with the Government of Alberta Sour Gas Release Plan;
- Air monitoring information on ambient H_2S concentration levels will be made available to the public on a regular basis throughout the duration of the sour gas emergency;
- At H_2S concentrations below 10ppm in unevacuated areas, individuals should consider leaving the area if health symptoms persist or become more severe;
- At concentrations that exceed 10ppm for eight hours or more, local conditions are to be assessed and all persons may be advised to evacuate;
- If concentrations approach 20ppm or more over a three minute average, evacuation of all residents will take place.
- Ignition would be required if there is an uncontrolled release from very high potential H_2S release rate wells which are located near population centres where evacuation would not be feasible. (The ERCB may delay ignition if it was satisfied that control could be quickly regained and that the health and safety of the public would not be at risk.)
- Decisions to ignite the release, if the Operator has not already done so, would be made by the Board with advice from industry and other government agencies.

d) IL 88-17 (IGNITION EQUIPMENT FOR DRILLING CRITICAL SOUR WELLS):

- All critical sour wells are to have dual well ignition systems during the drilling of the

well. A primary ignition system shall be installed such that activation can be achieved from a safe location through a time delayed triggering device;

- The backup system may be a manual system, such as a flare gun;
- The Board may waive the dual ignition requirement where the consequences of delayed ignition are considered minimal (such as in remote or uninhabited areas). Applications for waiver should be submitted with the emergency response plan, but not as part of the plan.

e) ID 88-9 (AMENDMENT OF ERCB ID 87-2):

- An urban centre is designated as a city, town, new town, village, summer village, hamlet with more than 75 people, or other incorporated centre.

f) ID 87-2 (SOUR WELL LICENSING AND DRILLING REQUIREMENTS):

- Certain sour wells, generally those with a high H_2S release potential or those near dwellings, require site-specific emergency response plans. These plans are to be submitted to and approved by the ERCB;
- The Board's policy is to ensure that if there is a significant release of H_2S, the health and safety of the public must be protected either by their evacuation from the area, or if evacuation is not practical, by ignition of the well.
- An emergency response plan is required for critical wells; when there is one or more dwellings, public facilities, worksites, or businesses in the planning zone; or if the Board decides one is needed;
- For critical wells, the Operator shall hold a meeting to review the emergency response plan before drilling into the potential sour zones. The Operator, its contractors, the ERCB, and government agencies should attend.
- For wells with a high H_2S release potential and an emergency planning zone that includes all or a portion of an urban centre, continuous mobile monitoring will be required on lease during the drilling, servicing or completion of the potential sour zones. Need for continuous mobile electronic monitoring for other sour wells will be reviewed on a site-specific basis.

g) ERCB Policies Dealing With The Overlap Of Planning Zones: Threats to public safety resulting from concurrent alerts, and changes in operating procedures as a result of a single alert, are perceived by the ERCB in cases with overlapping emergency planning zones. They have developed policies to deal with these situations. Should overlapping zones occur, consultation with the ERCB will be required.

British Columbia

Regulations surrounding emergency response plans in British Columbia are not structured to the same extent as in Alberta. British Columbia regulations are outlined in a **"Procedures Handbook"** (Appendices 6 and 7).

APPENDIX TWO - SAMPLE RESIDENT SURVEY QUESTIONNAIRE AND EVACUATION MESSAGES

EMERGENCY RESPONSE PLAN RESIDENT SURVEY QUESTIONNAIRE

Location # On Map _____
Distance From Well _____
Direction From Well _____
Phoner Assigned _____

WELL NAME: _____

Information Required For This Emergency Response Plan Is To Be Kept Confidential By (Operator's Company Name).

Family Names (Adults' First and Last) _____
Phone Number (Home) _____ **(Work)** _____
Mailing Address _____

_____
Postal: _____

Alternate Contact: _____
Alternate's Phone: _____

Number Of Residents:
Adults _____
Children _____
Preschool _____
Total: _____

School Bus Information
Times: _____
School: _____

Would You Or A Member Of Your Family Require Assistance In The Event Of An Evacuation? _____ **Which Member, And What Type Of Assistance Would Be Expected?** _____

Medical Susceptible? Yes No Nature Of Susceptibility? _____
Setback Restriction Notification? Yes No
Physicians Name And Location: _____
Comments Or Observations Made By Resident:
_____
_____
_____

Original Contact Date: _____ **By:** _____

Sketch In Resident Location And Access On Section Map Below:

NW	NE
SW	SE

Section ___ Township __ Range___

****BOLD INFORMATION IS MANDATORY***

SAMPLE NOTIFICATION/EVACUATION MESSAGES

Pre-written evacuation statements should be attached to the plan. In the event of an emergency, this will serve as a guide for emergency response representatives in contacting the public and will assist the company in ensuring a consistent message is communicated.

A sample **notification** message follows:

Mr./Mrs./Ms. _____, this is (Company Name) calling from _____. We have a potential problem at the _____ well location approximately ___km (west/north/east/south) of your house. We expect to have this problem taken care of shortly, and will be calling you back to let you know when things are back to normal. We would like to stress that this situation is still under control, and that this phone call is just one of our safety precautions outlined in our planning process. There is no need to leave the area.

Depending on the situation, the Operator may continue with the conversation and confirm filed information on assistance or medical sensitivity items. (ie: Our records show that you (need/don't need) help evacuating, and that there (are/are no) special medical concerns. Are these still true?____.)

Please don't use your telephone any more than necessary right now as it may make it more difficult for us to contact the neighbors. Thank you. If you have to call us back for any reason, our number is _____ .

A sample **evacuation** message follows:

Mr./Mrs./Ms. _____, this is (Company Name) calling from _____. We have a potential problem at our nearby _____ well location. As a safety precaution, we request that you evacuate (immediately, as soon as possible). Could you tell us how many people are currently at home? _____ Are any others expected home shortly? _____ Our records show that you (need/don't need) help evacuating, and that there (are/are no) special medical concerns. Are these still true?____. (If transportation assistance is required, ask the residence to stay indoors and close the windows and doors.)

Since the well is (insert direction from well) of your house, and the wind is blowing in a ____ direction, We would appreciate it if you would leave by the (discuss route on map). If you have difficulties, we will have our response people on the roads as well to help you.

Please don't use your telephone any more than necessary right now as it may make it more difficult for us to contact the neighbors. When you get to the Evacuation Reception Centre, please check in. And please contact us before you try to come back into the area.

Thank you. If you have to call us back for any reason, our number is _____ .

APPENDIX THREE - SAMPLE PUBLIC INFORMATION PACKAGE

Public information packages should be brief, yet informative. They should provide those that read them the key information on:

a) what the program is;

b) where it will be located, and what area is covered by the planning zone;

c) when the sour zones would be open;

d) what they would have to do if an alert was called; and

e) what the effects of exposures to various concentrations of sour gas.

When preparing these information packages, it should be remembered that non-technical explanations are required, and that extensive packages run the risk of never being read. Formats that compress the information into brief, less imposing documents should be considered.

If residents wish more information, it should be provided whenever possible.

An information sheet outlining the Operator's plans, the proposed location, effects of H_2S and SO_2, and a general description of the anticipated response planning issues should be given to the residents at the time of the resident visitation. If the emergency response plan structure has not been predetermined, residents should be advised that it will be passed to them once it has been developed.

Depending upon the situation, helpful information the Operator has the option of including in the public handout are:

a) details on the emergency response planning process used to develop the response plan;

b) information on the regulating agency regulations dealing with licensing and set back restrictions of sour facilities;

c) additional information outlining the definitions of terminology used in the regulations;

d) precautionary measures used at the wellsite to ensure well control and effective implementation of the emergency response plan ;

e) ignition criteria;

f) the Operator's position on compensation, as well as compensation procedures;

g) compensation claim sheets for out of pocket expenses;

h) copies of the notification and evacuation notices which would be read to them during alert situations; and

i) a brief summary of the company's history of operations in the area.

Sample Resident Handout

Introduction

Identify the Company and provide the Company address.
We are proposing to drill/complete/service a well in LSD __, Section __, Township __, Range __ W_M, approximately (directions in laymen terms), on (Landowner's name) property. In the course of drilling/completing/testing this well, we anticipate encountering Hydrogen Sulphide gas (also known as sour gas or H_2S). We prepare site specific Emergency Response Plans for wells containing H_2S to ensure that (Company Name) and the public are prepared in the unlikely event of an emergency. This package is provided to inform you of these plans.

(Company Name) Telephone Numbers
(Company Representative) Normal Business Hours
Emergency Number (24 Hour)
Regulating Agency Area Office Contact

In the event of any emergency, you will be requested to leave the area and proceed to our Evacuation Reception Centre at (location and address).

Well Information

- Name/location
- Total Depth or target zone
- Expected %H_2S, size of the emergency planning zone
- Spud date, penetration date, total number of days drilling/completing/testing
- future plans (general information if specifics are unavailable)

Evacuation

In the event of (insert general, non-technical conditions for public contact or evacuation), (Company Name) will promptly (advise/evacuate) all residents or transients in the planning zone. (Telephone/personal) contact will be used. Should we ask you to evacuate, we would hope you would go to the (Evacuation Reception Centre) to register so that others can find you. (Attach a map showing the residence locations, roadways out of the area, and the well location so residents can see how to leave the area without getting closer to the well than necessary.) If we had to call you, we would also be asking you if you need help with transportation. Concerns on livestock, pets or property should be passed to our representative at this centre. We will also be making some initial arrangements for compensation. (Company Name)'s policy is to fairly compensate those who have suffered damage as a result of our operations.

H_2S Information

H_2S is found in any location where there is decaying organic matter. It is often found in natural gas and oil, silos, and sewers. It is colourless, flammable, and at lower concentrations, smells like rotten eggs. Impact of H_2S on people varies with the concentration, length of exposure, and the individual.

We have attached a booklet prepared by Alberta Health on the effects of H_2S.

Sulphur Dioxide is a highly irritant gas formed when you burn H_2S. While it is more toxic than H_2S gas, it will have lower concentrations than the H_2S because of the effects of the burning.

APPENDIX FOUR - MEDICAL EFFECTS OF H_2S AND SO_2

Emergency Response Planners should become familiar with the health effects of H_2S. Alberta Health's **"Report On H_2S Toxicity"**[2] provides a current review of the literature and draws general conclusions on the effects of H_2S concentrations in the range of 0 to 20ppm. The executive summary is provided below. A handout based upon the results of this report has been prepared for the general public. It should be considered as a component of the public handouts.

The CPA Health Committee is also preparing a summary table of H_2S and SO_2 effects, and a review of SO_2 toxicity.

EXECUTIVE SUMMARY - ALBERTA HEALTH **"REPORT ON H_2S TOXICITY"**[1]

In October, 1982 a sour gas well being drilled near Lodgepole, Alberta blew out of control. For the next 67 days specialists fought to regain control of the well. As a result of this event and high public concern over the health risks associated with exposure to sour gas, the Energy Resources Conservation Board conducted an extensive inquiry into what happened, why it happened, and how it might be avoided in the future.

On of the recommendations arising from the Lodgepole Inquiry was the need for stricter exposure standards for those persons judged to be more susceptible to hydrogen sulphide (H_2S). As a result, a recommendation was forwarded to the then existing Provincial Board of Health for further consideration of this particular issue. In 1985 a committee was formed within Alberta Social Services and Community Health (SSCH) to complete this task. There was no industry representation on this committee.

In 1986, as a result of industry concerns, a new Ad Hoc Committee on H_2S with representatives from industry was struck to review the evacuation levels previously proposed by SSCH and the scientific rationale for each.

The specific terms of reference for the committee were:

1) To assess the scientific evidence for low level acute, subacute and chronic effects of H_2S on humans in the range 0 to 100ppm, and especially the 0 to 20ppm range.
2) To clarify the issue of the effects of low levels of H_2S on individuals.

The committee was asked to submit its final report to Alberta Community and Occupational Health, who would use it to develop evacuation guidelines for Albertans during uncontrolled sour gas releases.

The committee undertook an exte.nsive literature review and, where possible, obtained original articles, abstracts and review papers. Definitive data from well-designed studies were weighed

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1 "Report On H_2S Toxicity", Alberta Health, 1988.

against more anecdotal observations in the search for good end points from which conclusions could be drawn. The review included a comparison of animal research data, human experimental data and human epidemiological studies.

In conducting its critical special assessment, the committee relied on its collective technical knowledge of the health effects of H_2S, as well as its professional judgment in areas where scientific literature was not as strong as would be preferred.

As the committee initiated its review, it became increasingly clear that scientific terminology and concepts varied considerably from one discipline to another. In an attempt to minimize confusion for the reader yet to maintain scientific integrity in the discussion of various terms and concepts, the committee felt it worthwhile to provide some basic background. This is presented in Section II (of the report).

Based on the analysis of the scientific literature, it seems clear that some individuals may be more susceptible to the effect of H_2S than others. Other factors besides dose and duration of exposure may in part account for hypersusceptibility of a small proportion of the population to H_2S at low levels of exposure at any given time. These include:

a) mixed exposure with other chemicals at the same time (e.g. CS_2, CO, CO_2, SO_2, O_3, NO_x, NH_3, mercaptans or particulates) and/or recent exposure to chemicals in other settings (e.g. home, garden, work).

b) pre-exposure to medications, alcohol, and/or other drugs.

c) pre-existing and/or current diseases, physiological conditions (e.g. nutritional/hormonal status), psychological status, and cardiovascular impairment.

While the committee recognizes that the following do not represent all possible situations where hypersusceptibility may exist, categories of individuals who may be expected to show increased susceptibility to H_2S exposure include:

a) individuals with eye or respiratory tract problems - local irritant effects of H_2S could aggravate pre-existing conditions (e.g. conjunctivitis, eye infection, tuberculosis, viral pneumonia, asthma, emphysema, bronchitis).

b) individuals with severe anemia - certain data indicate that detoxification of H_2S requires the presence of adequate levels of oxygen in the blood.

c) individuals with lowered resistance to bacterial infections (e.g. immunosuppressed patients).

The committee concludes the following from its review:

1) H_2S by itself is a broad spectrum toxicant that can elicit numerous psychological and biological responses in the 0 to 20ppm range with which this review was concerned. As with any chemical all organ systems respond variably to different levels of H_2S with no given level affecting all systems equally at the same time or rate.

2) In general, single or repeated exposures of "normal, healthy adults" to H_2S in the 0

to 5ppm range have not resulted in clinically-detectable, irreversible biological or psychological effects. Whether this is true for hypersusceptible individuals is not currently known. This area needs further research.

3) Although reversible adverse effects may result in temporary discomfort or changes in organ function, they have not been found to have a lasting impact to date.

4) There are certain factors that may increase susceptibility of humans to H_2S for which the scientific evidence is not strong. These include the use of alcohol (Poda, 1966; Beck and Donini, 1979); age, as in the case of the very young, the elderly or infirmed; and pre-existing cardiovascular disease (USPHS 1964).

5) There remains a lack of good scientific data about the long-term, low level chronic effects on community populations and on the work force in sour gas operations.

NOTE: During the preparation of this report the department has gone through various name changes - from Social Services and Community Health, to Community and Occupational Health, and in September, 1988, Alberta Health was established.

The summary tables for the effects of H_2S and SO_2 are also presented.

APPENDIX FIVE - ADMINISTRATIVE REQUIREMENTS

Approval Processes And Timing

When emergency response plans are required by the ERCB (see Section 2.4), their approval will also be required. The approval process will vary depending upon the well classification.

Emergency response plans are submitted to the Environment Protection Department, located in the Calgary head office. A review will be conducted to confirm that the response plan meets the minimum standards outlined in the ERCB IL's and ID's. Once the Environment Protection Department approves the response plan, an approval letter will be prepared. (A copy of this letter is to be maintained on-site with the response plan.)

While the length of the review period may vary depending on the extent of revisions and the drilling activity, a five day review period may be anticipated for non-critical sour wells.

Special sour well emergency response plans undergo more scrutiny than do non-special plans. They are also reviewed in conjunction with the drilling or completion programs. Critical drilling emergency response plans require final approval by a Board member. As a result, the timing for approval is much more difficult to predict.

The emergency response plan approval process in British Columbia involves a review by the MEMPR in Fort St. John. Length of the review period may vary with the extent of revisions and drilling activity.

The review process is essentially the same for all wells requiring emergency response plans.

Waivers

The ERCB have established certain regulatory requirements for dual ignition systems[1] or mobile air quality monitors[2] in certain conditions (see Appendix One). They have also established procedures for Operators to request waivers on these requirements. (The MEMPR uses a less formalized process and determines these requirements through direct consultation on a well by well basis.)

A waiver of the requirement for dual ignition equipment on a special sour wells will be considered where the consequences of delayed ignition are considered minimal. The requests for waivers that are most likely to receive approval are those for wells in remote or uninhabited areas.

A dual ignition equipment waiver is to be submitted to the ERCB's Environment Protection Department at the same time as the emergency response plan is submitted for approval. Requests

1 ERCB's ID 90-1, IL 88-17.
2 ERCB's ID 90-1, ID 87-2.

for waivers should not, however, be part of the emergency response plan.

A waiver of the air quality monitor requirement is to be submitted to the Environment Protection Department as well. This waiver is used less frequently than the dual ignition waiver, as the mobile monitoring requirements are generally determined in consultation with the ERCB.

On-Site Review Meetings

A review of the emergency response plan is to be conducted for all special sour wells with site specific emergency response plans. This meeting is to be held prior to penetration or perforation of the special zone. Meetings should include an update of the contact phone numbers, a review of how the company's stages of response, the allocation of responsibilities, and the criteria used for decision making. Attendance by on-site personnel, the Operator's representatives, and the regulating agency is to be requested. Requests for attendance by others should be at the Operator's discretion, and should be limited to individuals with direct responsibilities in the emergency response.

Similar reviews should be conducted on-site for those non-special sour wells with site-specific emergency response plans. These meetings, however, would not normally require involvement of government agencies, and could be conducted as an agenda item in the regular on-site safety meetings.

Distribution To Government Agencies

Once approved, emergency response plans are to be distributed to the regulating agency, the local municipal government, the RCMP, and in Alberta, the Alberta Public Safety Services. Where other government agencies provide primary support in the response plan (eg: Forestry in many remote locations), they also should receive a copy. If other government agencies require information from these plans during an alert situation, it is to be obtained from the copy (ies) at the Government MCHQ.

The regulating agency should receive three copies. (In Alberta, only two copies will be required for non-critical wells.) The RCMP should have two copies directed to the sub-division offices, and in Alberta, the Alberta Public Safety Services will require one copy in their Edmonton headquarters.

Distribution should take place as soon as is possible after the well has spudded. (Operators may wish to delay distribution for long duration wells. Should this be the case, distribution approximately two weeks prior to penetration of the sour formation is recommended.) **Emergency response plans must be on-site before the surface casing is drilled out.**

If courier distribution is used, the response planner should be aware of the courier's requirements for specific street addresses and postal codes.

Procedures At End Of The Drilling Phase

Once the operation requiring the emergency response plan is finished, residents and the regulating agency should be advised of what is happening to the well, and how their protection will be provided when the response plan has been terminated. This can be accomplished by a statement that the well is being abandoned and no response plan is necessary, or by indicating which facility response plan will assume responsibility for the well.

Company contact information is to be provided to residents and the regulating agency for all wells that have not been abandoned.

Letters, personal visits, or phone calls are all acceptable for this contact.

GLOSSARY:

Air Quality Monitoring: Measurement for atmospheric concentrations of H_2S and SO_2. When used in context of mobile air quality monitoring equipment, it implies the measurement and recording through the use of mobile monitoring vans, and not through the use of hand held monitors.

Awareness Zone: The area outside the emergency planning zone that the Operator has scouted to identify locations of roads, public facilities, and major industrial operations. It is highly recommended that residence locations be included where possible, as an accurate description resident locations within this zone may be a determining factor in ignition decisions. The awareness zone is generally limited to the area within a radius twice that of the emergency planning zone. (Resident visits are not required for locations inside the awareness zone.)

Closure Order: An order issued by a regulating agency during an emergency situation which restricts public access to a specified area. Often referred to as an FH Order.

Completions/Servicing Stage: Includes all operations which are continuously attended subsequent to the drilling stage, and which are necessary to prepare the well to produce, or after a period of production, to restore the well or to repair the well.

Corporate Response Plan: A planning document which outlines what an Operators' resources are, how they will be brought into action, and how these actions will be coordinated. Corporate Plans should identify which human resources would be assigned key roles; including communicating with the residents and media.

Critical Depth: The depth at which a "critical" (or "special" zone) is anticipated.

Critical Period: Any period where operations on a well occur and a "critical zone" (or "special") is open.

Critical Sour Well: A designation by the ERCB that reflects the well's proximity to an urban centre and its maximum potential H_2S release rate. (Synonymous with the term "Special Sour Well" used throughout these guidelines.) Wells that have H_2S release rates above $2m^3/s$, or an H_2S release rate between $0.1m^3/s$ and less than $0.3m^3/s$ within 1.5km of an urban centre, or an H_2S release rate greater than $0.3m^3/s$ and less than 5km of an urban centre, or any well the ERCB designates, are special sour wells. (The MEMPR in British Columbia uses the term "Special sour well" for an equivalent well.)

Drilling Stage: The drilling phase of a well, beginning with the spud and ending with the cementing of production casing or well abandonment.

Emergency Operations Centre: The emergency centre that has the Operator's senior technical official responsible for the incident response.

Emergency Planning Zone(EPZ): The area around a sour well which the Operator would evacuate if the emergency plan evacuation criteria has been met.

Emergency Response Plan(ERP): A plan that outlines the Operators' procedures to protect the public during well control incidents which have the potential to develop hazardous levels of H_2S.

Energy Resources Conservation Board (ERCB): The regulating agency for the energy industry in Alberta. It administers the regulation, approval, and implementation of Emergency Response Plans.

EOC: Emergency Operations Centre

Evacuation Reception Centre: A registration centre for members of the public that have been evacuated from the emergency planning zone. It may also provide lodging.

Evacuation Coordinator: The individual designated by the Operator to coordinate the public

notification and/or evacuation activities.

FH Order: A Fire Hazard Order. Also referred to as an "FH Order" or a "Closure Order".

Fire Hazard Closure Order: An order issued by a regulating agency during an emergency situation which restricts public access to a specified area.

H_2S Evacuation Level: The H_2S concentration level that triggers an evacuation. It is generally either 20ppm averaged over a three minute period, or 15ppm over a fifteen minute period.

H_2S: Hydrogen Sulphide. The toxic component of sour gas.

Hazard Area: The area in the vicinity of a sour gas release where a potential hazard to the public exists.

Hyper-sensitive: Reference to a reaction that is several orders of magnitude greater than that of the non-sensitized individual.

Hyper-susceptible: An individual whose constitution causes them to respond readily and intensely to a H_2S exposure. This response is abnormally reactive to the greatest extreme.

Informational Letter (IL): A formal means of communicating ERCB policy in general terms. Application is often open to more discretion and interpretation than the ID's.

Infrastructure: The organization of personnel and resources in a company or government agency.

Interim Directive (ID): A formal means of communication ERCB policy in specific terms.

Level Classification: A designation to stipulate separation distances of sour wells for land-use and public safety purposes. The level classification for sour wells is determined by assessing the maximum potential surface H_2S deliverability that can be attained against zero back pressure during the suspended/producing stage of a well.

Local Authority: The council of a city, town, village, summer village, county or municipal district; or
The board of administrators of a new town: or
In the case of an improvement district or special area, the Minister of Municipal Affairs; or
The park superintendent of a national park or his delegate: or
The Band Council of an Indian Band where an agreement is entered into with the Government of Canada designating the Band Council as the local authority.

Main Control Headquarters (MCHQ): An operations centre established by the ERCB at a suitable predesignated location to manage the larger aspects of the emergency. The specific emphasis is on coordination of government activities. The Government MCHQ also provides a public relations function which is to meet the information needs of the affected citizens and the media.

Medical Sensitives: An individual who responds readily and intensely to an exposure of H_2S.

Medical Susceptibles: One who has the capacity or the disposition to develop disease or be physically affected.

Ministry Of Energy, Mines, and Petroleum Resources (MEMPR): The regulating agency for the energy industry in British Columbia. It administers the regulation, approval, and implementation of Emergency Response Plans. The Energy Resources Conservation Board is the equivalent agency in Alberta.

Mobile Air Quality Monitors: A device that measures and records H_2S and SO_2 concentrations. The term generally refers to monitors mounted in vans. These monitors can provide the averaging function referred to in the ignition and evacuation criteria.

Municipal Emergency Operations Plan: Emergency or disaster plans prepared by a Local Authority.

Notice to Airmen (NOTAM): An order issued by Transport Canada which restricts the access to airspace.

OH&S: Occupational Health and Safety

Off-site Control Centre: An emergency response centre established by the Operator in the vicinity of the incident (but not at the incident site) to provide support. This support is primarily aimed at local issues, such as roadblocks, evacuation reception, or evacuation assistance.

On-Scene Command Post: An operations centre established by the Operator at the incident site.

Phoner: An individual assigned the responsibility of telephoning residents during an alert situation.

Planning Zone: A predetermined area around an incident site which would be evacuated by the Operator if situations warrant.

Potential H_2S Release Rate: The calculated H_2S deliverability that can be obtained at surface against zero back pressure with various flow configurations, expressed using units of m^3/s at standard temperature and pressure conditions. It can include flow from multiple zones.

PPM: Parts Per Million

Precautionary Evacuation: An evacuation of residences prior to their exposure to hazardous levels of H_2S.

Presubmission Process: A process used by the Operator to have the potential release rate and special / non-special status established determined prior to a well licence application. The process involves a submitting a geological evaluation of potential release rates to the regulating agency for approval.

Public Facility: A public building such as a hospital or rural school, or a major recreational facility situated outside of an urban centre. It includes other developments that the Board, after consultation with the appropriate interested parties, may designate as a public facility based on the complexity of evacuation, taking into account the number of people using the facility and the frequency and duration of their use.

Public Information Package: An information package prepared by the Operator for distribution to emergency planning zone residents. This package includes key contacts inside the company, an outline of the planned activities, a summary of the emergency response plan and the effects of H_2S and SO_2.

RCMP: Royal Canadian Mounted Police

Reduced Response Plan: An emergency response plan document that has a reduced level of detail provided. The emergency response is conducted by on-site personnel and does not involve a complex response organization.

Regulating Agency: The agencies responsible for regulating the energy industry. In Alberta it is the ERCB. In British Columbia it is the MEMPR.

Release Rate: Another term for the "Potential H_2S Release Rate".

Resident Surveys: Personal visits with residents inside the emergency planning zone. These visits are intended to inform the residents of the Operator's plans, and to obtain the residents' emergency contact information required for the response plan.

Sensitive: See "Medical Sensitive".

Separation Distance: The required distance between a sour well and developments such as individual permanent dwellings, unrestricted country developments, public facilities, and the corporate boundary of urban centres.

SO_2: Sulphur Dioxide

Sour Facility: Any facility which produces, processes, or transports sour gas. With respect to this guideline, it is a facility that has an approved facility emergency response plan.

Sour Gas: Natural gas, including solution gas, containing hydrogen sulfide (H_2S) [greater than 1% hydrogen sulphide in British Columbia].

Sour Well: Any oil or gas well expected to encounter sour gas-bearing formations

during drilling, or any oil or gas well capable of producing sour gas.

Sour Well Plan: A stand-alone public safety emergency response plan for a sour well.

Special Depth: The depth at which a "special" (or "critical" zone) is anticipated.

Special Period: Any period where operations on a well occur and a "special zone" (or "critical") is open.

Sour Well: A designation that reflects the well's proximity to an urban centre and its maximum potential H_2S release rate. (Synonymous with the term "Critical Sour Well" used by the ERCB.) Wells that have H_2S release rates above $2m^3/s$, or an H_2S release rate between $0.1m^3/s$ and less than $0.3m^3/s$ within 1.5km of an urban centre, or an H_2S release rate greater than $0.3m^3/s$ and less than 5km of an urban centre, or any well the regulating agency designates, are special sour wells.

Stage 1: A precautionary alert level in an emergency response plan.

Stage 2: An alert level called when there is an emergency. Evacuation of the planning zone generally occurs at this stage.

Stage 3: An alert level called during major emergencies.

Susceptible: See "Medical Susceptible".

Supplemental Information: An information package intended to provide the site specific information required for a completion or servicing operation that the sour facility plan covering the well (or the area around it) does not already have.

Suspended/Producing Stage: Includes all operations which are not continuously attended, at wells that may or may not be capable of producing.

Uncontrolled Flow: Unrestricted flow at surface that cannot be shut off at the Operator's discretion. Examples include:
With drill pipe in the hole:
*Open annulus - flow up the annulus with the BOP stack inoperative and pipe rams and annular preventer essentially open.
*Open drill pipe - flow up the drill pipe with the stabbing valve not installed or inoperative in the open position.
*Material failure - flow through cracks, seals, and gaskets below the lowest pipe rams.
*Flow around the outside of cemented casings or through ground fissures.
With no drill pipe in the hole:
*Open well - flow up the wellbore with the BOP stack inoperative and blind rams essentially open.
*Material failure - flow through cracks, seals, gaskets, etc. below the lowest blind rams.
*Flow through the outside of cemented casings or through ground fissures.

Transient Survey: A visual check of an area for transients. Usually conducted on a regular basis while a sour zone is open in a remote location. Intention is to identify any people that are in the planning zone that have not been identified in the original area survey. Outdoor recreation, temporary worksites, or campers are main examples. Does not usually include those passing right through (highway traffic).

Unrestricted Country Development: Any collection of permanent dwellings situated outside of an urban centre and having more than eight permanent dwellings per quarter section, or any other similar development the Regulatory Authority may designate as an unrestricted country development.

Urban Centre: A city, town, new town, village, summer village, hamlet with not less than 50 separate buildings, each of which must be an occupied dwelling, or other incorporated centre, or any similar development the Regulatory Authority may designate as an urban centre.

INDEX

Air quality monitoring 23, 54
data to public 42
Air quality monitors 31
Department of Environments 23
evacuation crews 30, 31
mobile 32, 43, 51, 55
urban centres 41
Alberta Health
guidelines 4
pamphlet 14, 47
Report On H2S Toxicity 48
Alert level 57
Alert levels 24, 37
Approval
emergency response plan 4
process
ERCB 51
MEMPR 51
resident information package 14
Approvals 4
Awareness zone 18
Closure Order 54
COGLA 3
Compensation 4, 31, 42, 46, 47
Confidentiality
resident information 13, 15
Configuration
planning zones 20
Corporate response plan 10, 35, 39, 54
Critical well
completion or servicing operations (Alberta) 41
definition 54
licencing 5
see Special Well 3
Deferment
mobile monitor requirements 32
Distribution list 35, 36, 38, 52
Downgrading alert levels 28
Dual ignition systems 5, 42, 51
waiver 51
Emergency Operations Centre 22, 54
Emergency planning zone 54
configuration 18
concentric zones 20
oblong shapes 20
single zone 20
equations 18
manageability 20
maximum radius 18
multiple sour zones 18
overlap 4, 43
population densities 18
size 18
Emergency response plan 54
Equipment lists
communications 29
ERCB
see Regulations,ERCB 4
Evacuation 17
air quality monitors 31
and the MCHQ 22
and well ignition 17
beyond planning zone 20, 42
confirmation 30
coordination 23
criteria 26, 37, 42
general public 5, 11, 17
inner zone 20
mandatory 4, 26
messages 30
precautionary 17, 25, 26, 27, 56
public facilities 28
reduced plan 10
roadblocks 23, 27, 29, 30, 31
sensitives 42
susceptibles 4, 27
transient surveys 27
well ignition 28
Evacuation Coordinator 23, 29, 54
air quality monitors 23
communication 29
notification 25
phoner messages 30
re-entry decisions 27
Evacuation Crews 30
selection 26
Evacuation criteria 26, 39
Evacuation reception 22, 24, 29, 31
Evacuation reception centre 12, 24, 54
FH Order 27, 55
Government Main Control Headquarters 20, 21
H2S 55
evacuation criteria 26, 37, 42
health effects 14, 48
release rate 5, 56
Helicopters 27, 29, 37
Historical concerns 11, 12, 15, 28
Hyper-sensitive 55
Hyper-susceptible 55
Hypersusceptibility 49
Ignition criteria 4, 37, 39, 42
Industry precedents 12
Information exchanges 13
Livestock 14, 27, 42
Main Control Headquarters 23, 55
Company representative 22
functions 21
ignition decision 28
link to operations 22
Maps
planning zone 32, 37, 38
regional 32, 38
scale 33
MCHQ
facilities 22
link to operations 23
see 'Main Control Headquarters
Media updates 22
NOTAM 27, 55
Notification
messages 30
Odour complaints 24
Off-Site Control Centre 22
On-scene Command Post 56
agencies on site 23
function 23
On-Scene Commander 23
On-site review meeting 43, 52
Overlapping zones 4, 43
Phoner 29, 56
limitations 30
size of telephone list 30
training 26
PPM 56
Pre-penetration meeting
see On-site review meeting 43

Presubmission process 56
ERCB 5
MEMPR 5
Prevailing wind conditions 20
Public concerns 11, 12, 22
historical 12
public and MCHQ 22
Public Consultation Guidelines 11, 15
Public facilities 13
on maps 33
Public Facility 56
Public information package 13, 37, 46, 56
approval 14
see also resident survey 13
Public Safety Services 21
Public-Media Inquiry Room 22
RCMP 25, 31, 52
Reception centre
see evacuation reception centre 12
Reduced plan 7, 10, 56
commitments 39
content 38
requirements 10
Reduced planning zone 37
Regulating Agency 56
Regulations
ERCB
compensation 4, 42
completion and servicing 41
completions/servicing 4
evacuation 4
evacuation and ignition for sour wells 42
ID 87-2 5, 43
ID 88-9 43
ID 90-1 4, 41
ignition 4
ignition equipment 5, 42
IL 88-17 5, 42
IL 88-2 5
IL 89-15 4, 42
IL 89-20 4, 42
IL 89-4 5
notification of rural authorities 5
overlapping zones 4, 43
public involvement 5
Sour well licencing 5, 43
MEMPR 5, 33, 43, 51
Requirements
for emergency response plans 6, 43
on-site review 52
plan on site 41
to do reduced plans 10
to do sour well plans 7
to do supplemental information 10
Resident information package
Delivery 14
Resident notification
concentric zones 26
messages 26
Resident questionnaire 13
content 14
Resident survey 12, 13, 56
intent 13
see also Public Information Package 45
who's to do it? 14
Response level criteria
stage 1 24
stage 2 24
stage 3 24
Response level examples
stage 1 24
stage 2 24
stage 3 24
Roadblocks 23, 27
communication 29
kits 29
marking 30
on numbered highways 31
RCMP 31
relocating 31
Scope 1
Sensitive 48, 55
See 'Medical Sensitive' 56
Sensitives 42
Separation distances 5
Servicing 7
air monitoring 32
ID 90-1 4, 41
requirement for response plan 6
supplemental information 35, 39
Shelter 17
Site Specific Emergency Response Plan 35
SO2
evacuation criteria 27
ground level concentrations 17
Sour facility 56
emergency response plan 7, 10, 35, 39, 41
guidelines 1
Sour gas 56
Sour well 56
Sour well plan 7, 35
contents 35
Special sour well
completion or servicing operations 41
definition 3, 57
ERP 6
response plan review 51
Stage 1
criteria 24
examples 24
Stage 2
criteria 24
examples 24
Stage 3
criteria 24
Stage One
notification
public 25
response personnel 25
roadblocks 27
Stage Two
NOTAM 27
notification
public 26
Structure
emergency response 37, 39
of guidelines 1
Supplemental information 7, 41
requirements 10
within sour facility planning zone 39
Susceptible 27